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THE FOUNDRY

Established in 1892 by John A. Penton

CONTENTS for FEBRUARY 1933

Volume 61 Number 2

EDITORIAL 9
Good Housekeeping at Falks 10
Humidity in Oil Sand Cores 13
Order and Cleanliness Give Theme to Conference 14
Special Steels for Castings 15
Science Perfects Bell Making 17
Through the Years with the Foundry 18
Control Features Steel Foundry 20
Sees Radical Stand Necesary 23
Effect of Alloys on Cast Iron 24
Deoxidizers for Brass Alloys 26
Handling Materials in a Brass Shop 28
QUESTIONS AND ANSWERS 30
Viewing Foundry Developments at Short Range 33
The Foundry Family Photograph Album 34
MEN OF INDUSTRY 35
READERS COMMENT 38
Prevent Losses with Proper Gates and Risers 41
Gray Iron Institute Considers Certification Plan for Castings 50
The Adventures of Bill 56
European Foundry Practice 64
Obituary 65
New Equipment for Foundries 66
FOUNDRY ACTIVITIES 67
New Trade Publications 68

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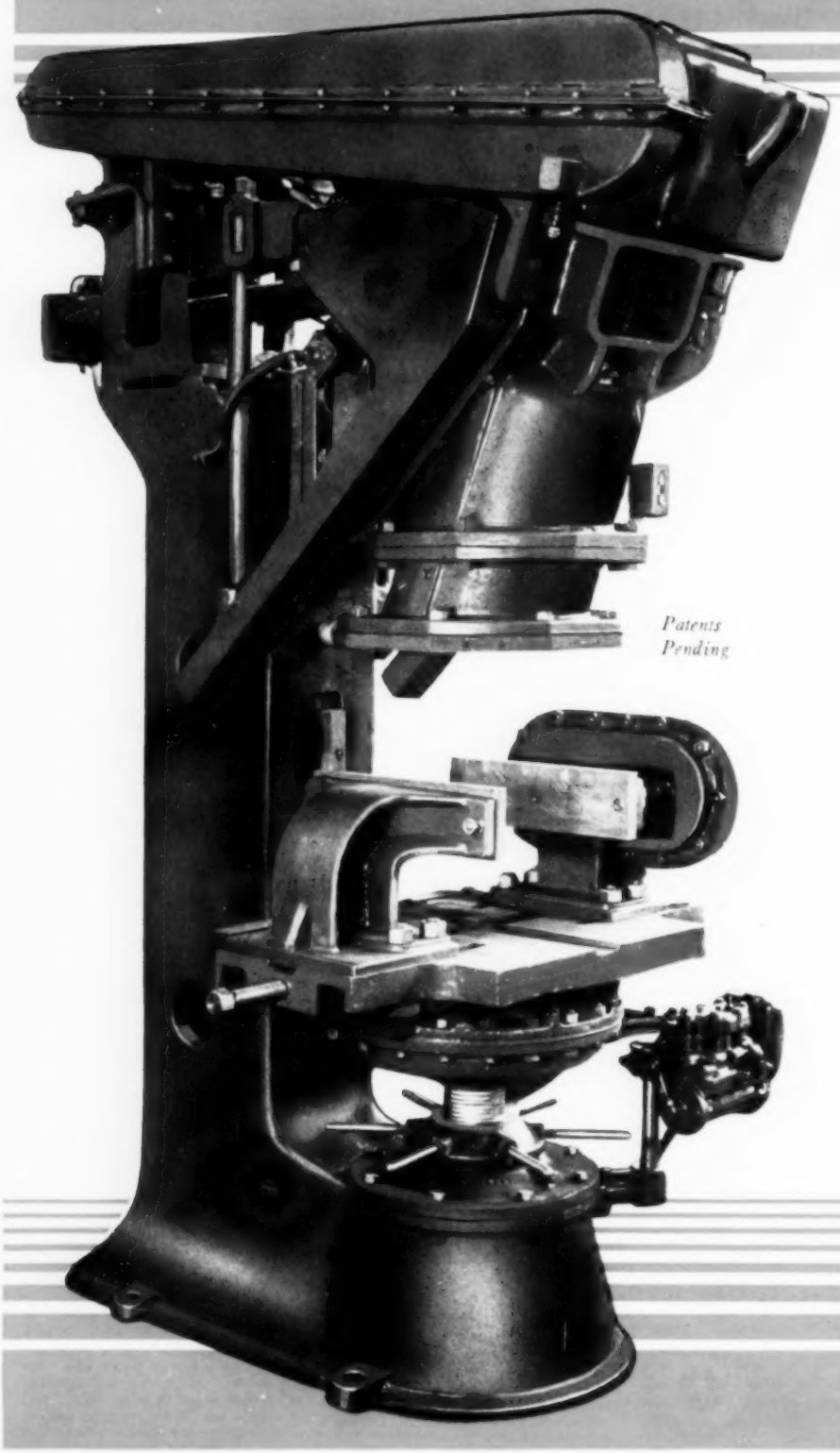
BIG NEWS



Patents Pending

At last the heavyweight range of cores has been brought under control.

Cores up to 80 and, in many cases, up to 100 pounds can now be blown on a CONTINUOUS production basis.

The Osborn-designed agitator in the sand chamber prevents the formation of sand "craters"—the foes of continuous operation of all previously designed core blowing machines for even medium-size cores.

Cores blown on the Osborn No. 95 Core Blowing Machine are of uniform porosity and density, even when the cores are intricate or delicate in design.

Operation of the No. 95 Machine is remarkably easy.

Every element of design and construction was carefully planned

THE FOUNDRY for February

Biting the BANKER

AT A RECENT foundry trade association meeting a humorist elicited real glee by an anecdote about a dog that bit a banker and then two other citizens to take the taste out of his mouth. Foundrymen are not cruel. Their evident amusement at this story indicated no gory tendencies. Perhaps it reflected some of the popular feeling toward bankers, present wherever business men and manufacturers gather. Pressure to pay debts, reluctance to extend vitally needed credit, management solely for liquidation ends under banker direction, all play a part in the reaction of which this incident is a symptom. When will bankers awake to the fact that credit is the commodity in which they deal? When will they offer this commodity for sale, for their profit and to promote and sustain industry?

Buying to DESTRUCTION

ONE hopeful sign wherever foundrymen gather is an evident groping for co-operation. Less prevalent is the classification of all competitors by profane species and genus. Declining faith in the buyers report of competing prices is noted. The telephone or friendly call is wiping out suspicion of bad faith engendered against others in the foundry business. But buyers have not yet come to grace. No revival of ethics is widely observed or adherence to the creed that the purchaser takes no underhand advantage or seeks to buy below cost. On the contrary, many purchasers must recognize that they are obtaining castings below cost. They must realize that they are indirectly driving lower the wages of men, in many cases already below the subsistence level. They are chiseling away the foundation of their own sales structure and destroying the buying power of prospective customers. The blame for destructive buying today in many, many cases must be placed upon the buyer and not rest upon the ignorant or misguided seller of castings or other products.

At Public EXPENSE

WHENEVER the question of economy in public expenditures affecting office holders pay is mentioned in Congress, among the forty or more legislatures now in session, in county, township or city governing bodies, reductions offered are trifling. These ostriches in public office today suffer agonies to lay a bantam egg of saving. Yet when any sort of public work is spread before the hungry horde of contractors and purveyors, economy becomes the watchword and public officials become the champions of the public, rampant for large percentages. The prices paid for castings upon public work are mentioned with apology, by the maker, and should be a source of shame to the customer—if officeholding purchasers are capable of such feeling.

What's New In FEBRUARY

ENCLOSED and ventilated machine operation, spotless floors, walls and windows and order in arrangement promote economy and safety in Wisconsin steel foundry, (page 10). How air conditioning affects strength, a new thought in core baking, (page 13). Heat treatment a vital factor in steel casting service, (page 15). New notes on bells—the American slant, (page 17). Taking the uncertainties out of steel foundry production problems, (page 20). Steel Founders hold to policy of no prices below cost, (page 23). How alloying elements improve gray iron, (page 24). Handling speeds production and reduces cost in brass shop, (page 28).

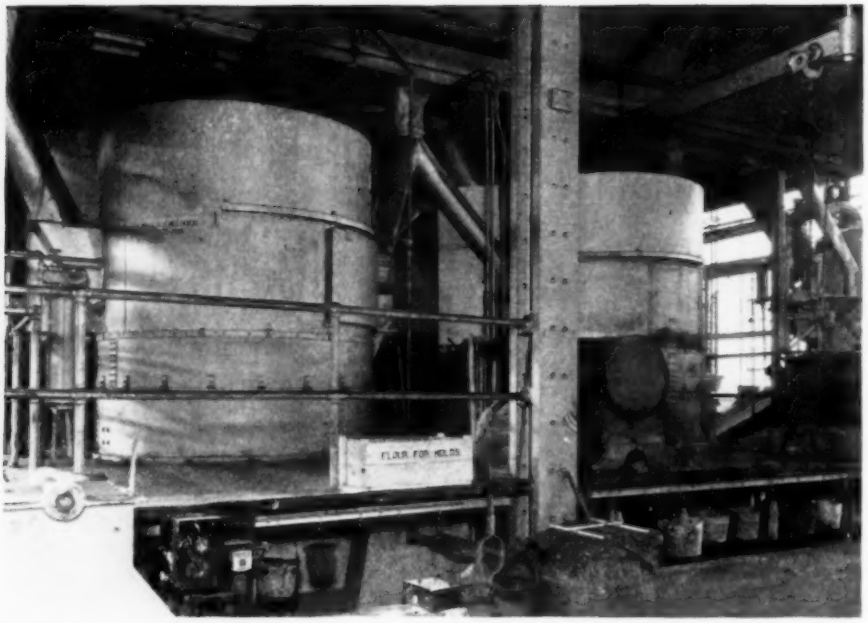


Fig. 1—All the sand mills have been enclosed as a part of the dust prevention program

Good Housekeeping at Falks

Remove dust accumulation, isolate sources and provide contrasts to hold high standard

By V. J. HYDAR

Apprentice Supervisor, Falk Corp.

REASONABLE compliance with dust legislation in the state of Wisconsin and, more particularly, a desire to keep men employed as much as is possible under present conditions have resulted in one of the most outstanding examples of foundry cleanliness in the country. The Falk Corp., Milwaukee, has put forth considerable effort in cleaning up its steel foundry and this good work still is being carried on to a considerable extent.

Of course dust legislation has set all foundry operators on their toes with regard to ordinary cleanliness in the prevention of pulmonary diseases. The theory at the Falk plant has been that just a cleaning up will not solve the problem. We have gone a step farther and have painted a considerable portion of the shop in white and light shades so that dust and dirt will show up readily and will not be permitted to accumulate in the future.

Removal of dust accumulation and isolation of sources of dust will serve sufficiently the purposes of dust regulations in the laws but the incentive to maintain that standard at all times can come only from the contrasts which light colors in the painting of buildings and equip-

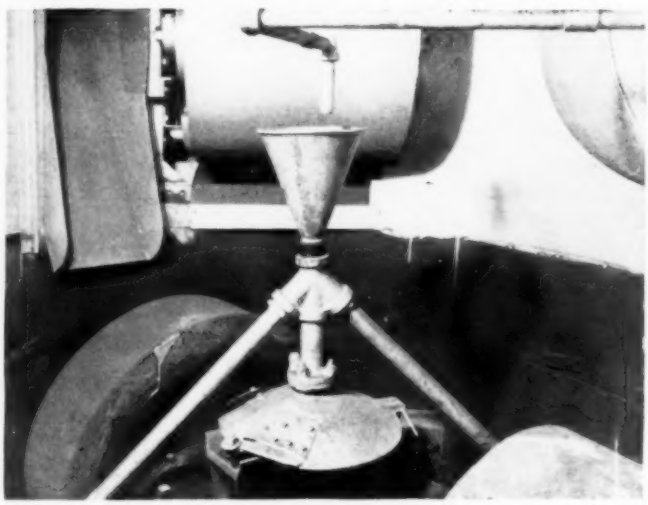


Fig. 2—View of the interior of one of the enclosed mills. Water and molasses are delivered through the pipes and the sand and other dry materials enters through the ports

ment can give. We hope also, that cleaner surroundings will be reflected in the personal habits of the workers thereby furthering the promotion of the health idea. To that end, new locker rooms have been installed and equipped with modern equipment.

Correction of the dust situation took the form of several activities. First, all dust accumulation on structural steel in the buildings was removed. Painting of columns, girders and trusses with aluminum paint and application of white paint to brick and masonry walls is proceeding at a fair rate. Reference to the accompanying illustration will show that a considerable portion of

Fig. 4—Canvas curtains may be drawn across the front of the booth and the fan collects the dust and blows it into a receiver on the outside of the building

Fig. 3—Close up of the water atomizer, which consists of an old welding or cutting tip

the shops already has been painted. Regular foundry employes have done all this work, and the work has been rotated among them to spread employment as much as possible.

Windows have been washed and are being kept clean while periodic attacks on the gathering places for dust prevent further accumulation. In preventing these accumulations of dust we avoid the possibility that explosions and similar disturbances will shake huge volumes of it from beams and girders into the atmosphere.

Cost of removing dust accumulations will not be as great as one at first will conclude. Recently, two night men completely cleaned a small bay of the chipping room, 25 feet wide and 525 feet long for a total labor cost of about $9.00. The larger bays in the shop can be cleaned about as readily as the small ones because they are equipped with cranes from which the men may work without the necessity of frequent climbing up and down.

Spraying sand floors is an important part of the daily routine while concrete floors are cleaned scrupulously at the close of each working day. Ordinary lawn spray nozzles are used for wetting down the floors of the foundry which are kept damp at all times.

Fig. 5—Every effort is made to prevent dust. One man is sprinkling the floor while another is using a water atomizer to remove dust from the atmosphere

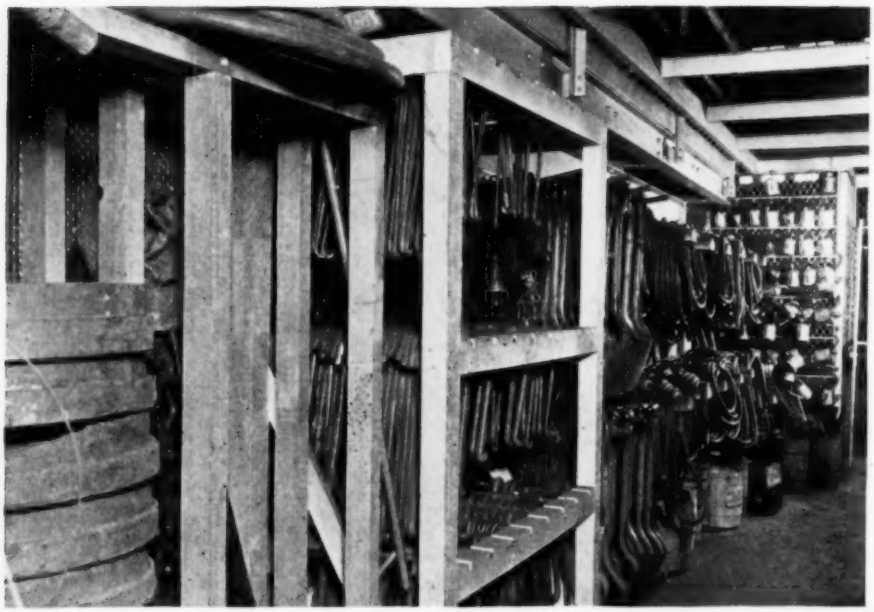


Fig. 6—All tools must be cleaned and put in good order before being returned to the tool crib

Ideas thus far mentioned have been carried out in practically all foundries in a reasonably successful effort at dust control. However, the Falk Corp. in its crusade on dust has installed dust collecting equipment in unusual places. The company is experimenting with various types of respirators and sandblast helmets and, coincident with these activities, has set up methods of housekeeping which go far toward making an orderly shop, although the methods may not be directly related to dust.

Enclosing sand mill equipment to eliminate a source of dust is one of the accomplishments along that line and the design and construction of the enclosures shown in Fig. 1 were carried out in our plant. There are three sand mills made by the National Engineering Co., Chicago in the group shown in Fig. 1 (part of the third mill appears at the extreme right) and two in another group. All are similarly enclosed. Hoods were made of black sheet iron riveted and welded to a light structural frame work. They were fabricated in the machine shop and afterward fastened to the mills by lugs. The interior of the mill is accessible through a sliding door. Dust is carried off through large pipes at the tops of the hoods which take it through a suction fan to a dust collector.

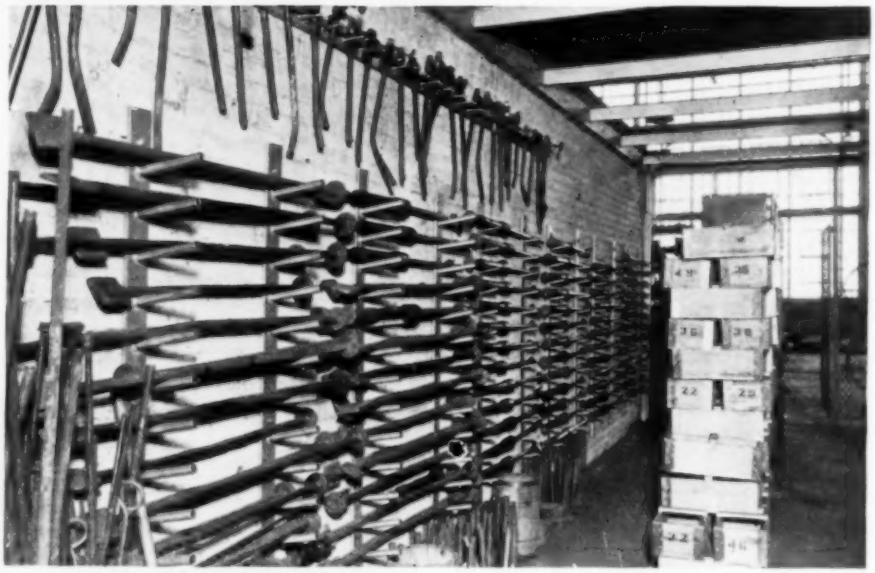


Fig. 8—Hand rammers, floor rammers and air rammers are stored in horizontal racks

Fig. 7—Steel bins have been constructed throughout the supply room and a small card inventory system is maintained. A sprinkler system gives protection against fire

Fig. 2 shows the interior of one of the mills. All parts of the equipment are readily accessible for lubrication and repairs. The pipe near the top of the illustration is

(*Please turn to page* 46)

Humidity and Oil Sand Cores

Tests indicate that moisture content of atmosphere influences successful drying

By A. S. COULTER
Werner G. Smith Co.

EXTENSIVE research has led to the conviction that atmospheric humidity plays a surprising part in successfully drying oil-sand cores. Tests, running into the hundreds and extending over a long period of time, have brought out interesting and pertinent facts relative to core strength and speed of baking. Every foundryman knows that on some days his cores seem particularly good; that is they are well baked and strong, and give off a minimum amount of smoke and gas. At other times the cores are not satisfactory. Some are underbaked and the foundry is filled with disagreeable smoke and gas. Perhaps the cores are brittle from overbaking.

One after another the familiar excuses are advanced: The oil is not uniform, ovens are no good, sand has been changed, the man running the mixer has slipped. Perhaps the next day the cores are all right and it is taken for granted that, whatever the trouble might have been, all is now in order. However, much of the difficulty may have been due to relative humidity of air passing through the core ovens. Temperature, barometric pressure and humidity are the common variables from day to day. We may eliminate temperature for obvious reasons. Variations in barometric pressure are comparatively small but there are abrupt changes in relative humidity.

Since linseed oil has been accepted generally as the measuring stick of all compounded oil binders, we selected it as a medium for definite tests to determine what factors are responsible for the ever recurring variations in cores. We observed that on some days linseed oil produced an average core strength of 125 pounds per square inch and on other days that strength increased to 175 pounds. In every case there was no variation in the procedure.

It follows, therefore, that if the core of 125 pounds strength is a (*Please turn to page* 52)

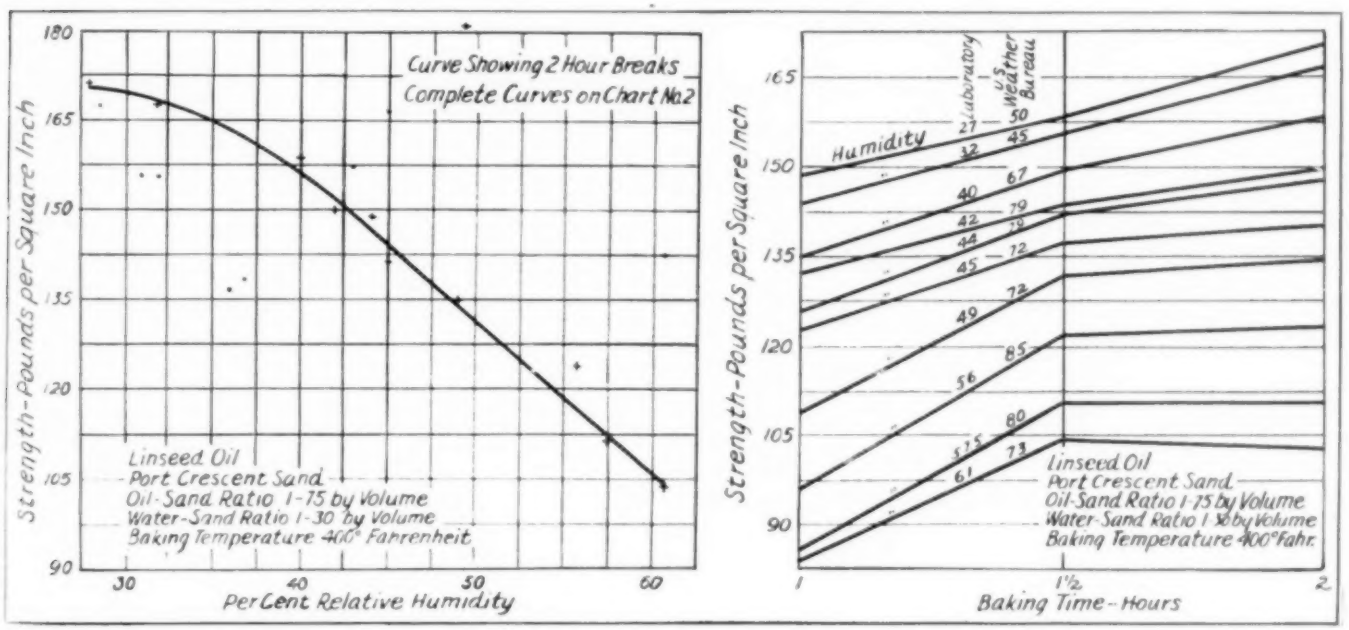


Fig. 1 (Left)—Strength results of a 2-hour bake from each test plotted against relative humidity. Fig. 2 (Right)—Complete strength curves of a group of selected tests. Low humidity produces greater strength

Hall of Science and interior of the Great Courtyard at the Century of Progress exposition in Chicago

Order and Cleanliness Give Theme To Conference

PLANS for the detailed program of the American Foundrymen's convention which will be held at the Hotel Stevens, Chicago, during the week of June 18, are nearing completion. A feature of unusual value is a conference on the subject of good foundry housekeeping. The value of order in arrangement and proper storage and handling is recognized more keenly under present operating conditions, where every avoidable waste may be converted into a saving in cost. Small items of equipment and manufacturing appurtenances, when classified, arranged in proximity to the places where they are used, and saved from loss or damage, constitute an important factor in economy of manufacture.

Safety Considerations Important

Further, safety considerations have an important bearing. Clear aisles, avoidance of clutter and disarray contribute directly to the reduction of lost time accidents. An orderly shop, almost without exception, is a clean shop and cleanliness particularly in the avoidance of accumulations of dust and dirt removes hazards to health.

These questions, discussed from the standpoint of improving working conditions and lowering costs, will form the theme of the good housekeeping session. Competent advice from foundry operators will be available and manufacturers of equipment designed to reduce the hazard of dust will offer their experience for the benefit of all interested in these questions.

The A. F. A. in providing this opportunity for the exchange of information has obtained the co-operation of the National Founders' association and the National Safety council. Through these active national associations, whose representatives will lead the discussions, the foundrymen participating in this conference will have an unusual opportunity to crystalize thought upon these important questions before the industry.

Hold Special Session on Costs

Other features of the program dealing with progress in technical lines will provide the latest and most advanced information on practical and scientific accomplishments. Roundtable and shop course meetings will be scheduled to cover the various branches of the industry and specific phases of products and processes related to castings manufacture. The question of foundry costs, vital under present day conditions, will center attention at a special session under direction of the cost committee.

Proper consideration is being given by the A. F. A. management to provide a division of time so that all of the attractive features of the convention may be available to those attending. Scheduling of technical sessions will avoid conflict of interest, and time will be offered for studying the exhibition to be held in the hotel and also to permit attendance at the Century of Progress exposition which opens two weeks before the date of the foundrymen's convention.

Special Steels for Castings

Countless combinations give desirable properties after proper heat treatment

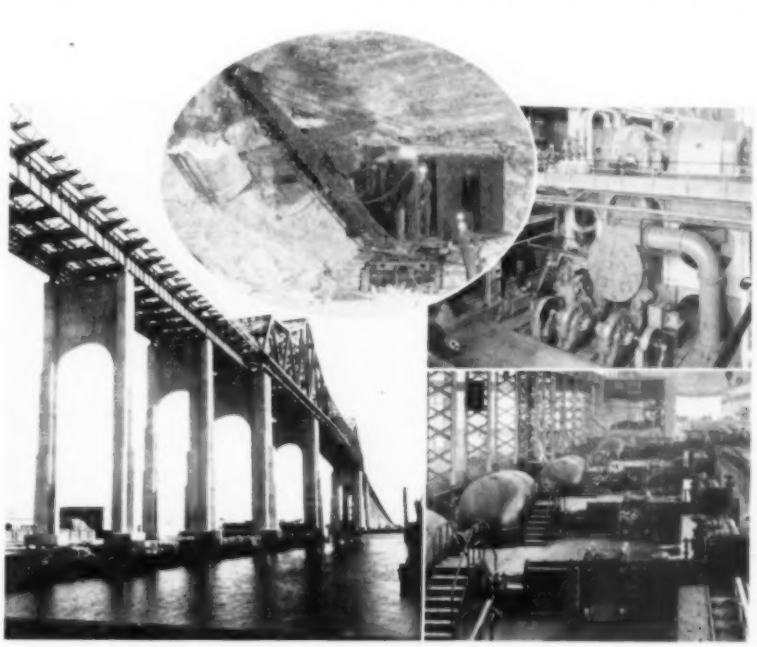
By R. A. BULL

COMMON steel used for castings has in the past been classified ordinarily into *soft*, *medium*, and *hard* grades. Through progress in the melting of carbon steel for castings, what was previously termed as *soft* or *medium* is not now classified narrowly and correctly under either of these headings. Illustrating this fact, the current specification of the American Society for Testing Materials for miscellaneous carbon-steel castings designates as the *soft* grade of such steel material that may have no more than 60,000 pounds per square inch tensile strength, while the so-called *medium* grade must have not less than 70,000 pounds per square inch tensile strength. Some consumers unfamiliar with steel foundry practice have the idea that the 70,000-pound grade of cast carbon steel, because it has been termed *medium*, is not claimed or found to be economically machineable.

The terms *soft* and *medium* have been applied, respectively, to common steel for castings required to show not less than 60,000 and 70,000 pounds per square inch, continuously since the testing society adopted in 1901 its first steel-casting specification. During the elapsed period of more than three decades, the producing industry has made great advances, so much so that what originally was applicable in grade nomenclature does not now fit the situation. The grade of carbon cast steel now properly designated as *soft* machined very easily, and as put today into miscellaneous castings for ordinary structural purposes, probably averages not less than 75,000 pounds per square inch tensile strength. It is characterized by a much higher degree of ductility than is needed for many structural applications that call for yield point and tensile strength values much greater than those typical of carbon steel, even after it is quenched intelligently in a liquid and drawn.

These explanations are made as a fitting preliminary to brief mention of liquid quenching, as related to the subject. It seems quite proper to many to assert that the combined effect of liquid quenching and tempering is to change regular or common steel into special steel, even though the chemical composition is ordinary. It is important to realize that carbon steel made for castings is quite susceptible to heat treatment, especially when the treatment includes oil or water quenching. Resulting tension-test and other values are impressive, in comparison with some varieties of alloy steels, particularly when the latter are not given heat treatments serving to develop skilfully the physical properties inherent in the material. Unquestionably, proper quenching in water followed by drawing is a safe, effective operation for many carbon-steel castings.

To prevent misunderstandings, perhaps it should be explained that the term *heat treat-*



A mechanical engineer in selecting materials must be guided by actualities as to first cost and the probabilities of service

ment as now employed by most metallurgists means any kind of treatment involving the application of heat, following the cooling of the metal during solidification. The term means just what it implies to one who has never used metals—in other words, treatment by heat, whether by one or more operations and whether subsequent cooling is attended purposely by circumstances accelerating or retarding the return to normal temperature.

The author has touched upon the large number of varieties of alloy steels being manufactured for castings. A listing of some of these varieties may be useful to indicate appropriately what the author has chosen to term the versatility of the steel casting.

Roughly speaking, alloy steels for castings are classed as high and low, although there is no authoritatively established basis for differentiating between these groups. At present, classification becomes a matter of preference of the individual. The author makes a distinction between low-alloy and high-alloy cast steels, on the basis of 7.0 per cent, but without contending that this basis is correct for general purposes or that the author's temporary procedure is the most satisfactory one that could be employed for this contribution. With this explanation, the following list giving a score of low-alloy cast steels is presented. It includes some but by no means all of the grades of alloy steels used for castings, while excluding grades or classes that contain any element having as large a proportion as 7.0 per cent of the whole. These are as follows: Chromium, chrome-molybdenum, chrome-tungsten, copper, medium manganese (1.10-2.00 per cent, often 1.25-1.50 per cent Mn), medium manganese-chrome, medium manganese-copper, medium manganese-molybdenum, medium manganese-nickel, medium manganese-silicon, medium manganese-vanadium, medium manganese-chrome-molybdenum, medium manganese-chrome-vanadium, medium manganese-nickel-molybdenum, molybdenum, nickel, nickel-chrome, nickel-copper, nickel-vanadium, vanadium.

Need Scheme of Classification

The large variety of low-alloy cast steels cannot be appreciated from the list without bearing in mind that there have been made separate grades, according to the desired percentages of important elements, in each kind enumerated. For certain kinds there are as many as four grades, each producing a result noticeably differing from those in the other grades of the same roughly classified kind of steel. Thus there are probably not less than 60 varieties of steel represented in the listing—many more as to number, admittedly, than are necessary to supply the needs of all consuming industries for the product.

Consuming industries seem to need a scheme for classifying casting steels, either from the standpoint of chemical composition or from the standpoint of typical performance, or from the combined standpoint of several representative factors. The absence of a generally accepted classification plan has, probably to large extent, been responsible for the frequent selection of trade names given to varieties of cast alloy steels. Without meaning to decry this commercial practice, the author believes the trade-name habit has produced confusion among some consumers and that this circumstance is one of several justifying a movement that may be inaugurated and that might happily result in a classification nomenclature that would be self-indicative to engineers.

Refers to Manganese Steels

What the author often has declared regarding the discretion that should be used in respect to chemical limitations should not be construed as an argument against a user's legitimate insistence on getting, for example, a nickel-chrome steel for any given application, if the consumer believes his experience, supplementd by advice from the foundryman, perhaps, justifies the continued selection of a material that has demonstrated serviceability for the job in hand. However, consumers generally are not so conversant as they might wish to be with the fact that, following metallurgical investigations that have cost a great deal of money and have developed much valuable information, one may now obtain (within the limits of expected deviation for any particular grade of steel) a certain impressive combination of the four tension-test properties, from each of as many as ten varieties of low-alloy cast steels. It is appropriate here again to suggest that reliance be placed on something more nearly conclusive than tension-test figures.

The relatively large number of medium manganese steels the author has listed seems to him to justify particular reference to this group, which has become popular within the last 10 years. Previous to that time it was demonstrated that what many foundrymen, including the author, call medium manganese steel and what some persons term intermediate manganese steel was a satisfactory grade of metal for many purposes that require more impressive physical properties than those typical of common steel, although not comparable to some kinds of alloy steels that have been applied for many years and are yet applied with satisfaction as to service. An advantage of plain medium manganese steel is its relatively low cost.

When industrial conditions brought about a greater degree of alloy-mindedness among consumers generally, inquiring foundrymen turned their hand to the experimental admixture of several special elements, in varying proportions, with medium manganese steel. The result has been an impressive number of what may be termed special grades (*Please turn to page* 53)

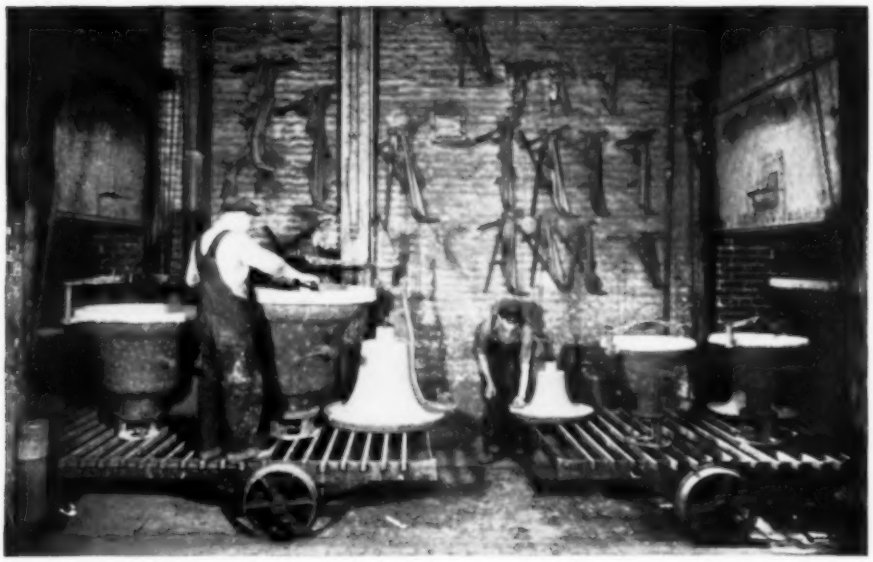


Fig. 1—Molds are carried to the ovens on special cars. Numerous strickle boards may be seen hanging on the wall

Science Perfects Bell Making

E. W. Vanduzen Co. has been manufacturing bells in Cincinnati for nearly one hundred years

By J. B. NEALEY

American Gas Association

WHILE bell founding is of ancient origin, the art of accurately tuning a bell, so that there is no dissonance between its five main tones, is comparatively new. These tones consist of the main, or strike note, the nominal, an octave above the strike note, and the hum which is an octave below, together with two other tones above the strike note, which are called the terce and the quinte.

A good bell has a full, soft melodious striking note which is true throughout from one stroke to another. Overtones in a good bell are harmonious with the strike note and with each other, ranging from the strike note to the nominal an octave above, and down to the hum note an octave below. Hence there is no dissonance whatever when such a bell is struck and the tones gradually die out.

A bell struck from the outside can be heard only a short distance, approximately a quarter of a mile, but a bell struck from the inside may be heard from 5 to 15 miles, depending on size, atmosphere, location as to height, etc. In that case the bell is struck by a heavy clapper while swinging with the mouth of the bell turned up.

Some 15 years ago the E. W. Vanduzen Co., Cincinnati, began analyzing bell tones and redesigning bells to eliminate dissonance. That concern has been (*Please turn to page* 58)

Fig. 2—In tuning a bell, the operator taps the bell and compares the tone with the tuning fork. He then grinds metal from the inside until the desired tone is secured

The Afoundria, launched at Rock Island in 1919 during the A.F.A. convention, and christened by Mrs. A. O. Backert. The ship still is in service

Through the years with THE FOUNDRY

DELVING into the activities of any division or section of the human race for a period covering several decades must reveal the pendulum movement of fortune and adversity. Whether news of social and political trends is gleaned from the newspapers of the day, or the history of industrial progress is gathered from the pages of the business press, the economic rise and fall of the people and the business and industrial structures which they have erected, presents a drama far more interesting than fiction.

Picture Industrial Trends

As the world today begins to discern the light of recovery following probably the most severe depression of all time, it is entirely natural that interest should center on periods of reconstruction following economic warfare. Therefore, the various sections of this series which have appeared in the October, November, December and January issues of THE FOUNDRY, have stressed industrial trends as they relate to the castings industry. Each article has shown that economically, history has repeated itself constantly since THE FOUNDRY was established by John A. Penton in 1892.

On Jan. 1, 1919, at the beginning of the period covered by this article, the foundry industry was in a state of uncertainty. Contracts for war materials, which had kept many foundries operating at capacity during the previous year, had been canceled immediately following the armistice. Governmental control of pig iron prices was terminated the first of the year, and for the first time in over 12 months, an open market for pig iron prevailed. As was pointed out in the January issue of THE FOUNDRY, "developments of the month indicate that our country was equally as unprepared for peace as it was for war."

Nevertheless the editors visioned accurately the course that lay ahead, and in February, THE FOUNDRY predicted editorially that "at not a very distant date an avalanche of orders for castings will engulf the foundries, and everything should be done to hasten that day." In March it was noted in a review of the trade outlook that "readjustment from a war to a peace basis is being felt more keenly in the steel casting industry than in any other branch of the trade." Malleable business was not good, due to a lack of railroad buying, and orders for gray iron castings were characterized as spotty. But underneath it all, an improvement was under way.

All Branches of Industry Busy

In April, THE FOUNDRY stated "a steady gain in activity is reported by practically all branches of the industry. None has returned to a normal basis, nor could this be expected after so complete a turn over of industry as that following the cessation of hostilities early in November." By September, the gray iron industry had reached the point where business on hand was more than sufficient to employ all available workmen. Other branches of the industry also were busy. The steel strike and also the coal

strike affected operations only slightly near the close of the year. While unprepared for peace following war activity, the industry was not long in settling in the harness.

All during 1919, the influence of tremendous war operations during the previous year was apparent in the articles appearing in THE FOUNDRY. In January, an article on "Wartime Experience with Women Metal Workers" stated that "their efficiency has been demonstrated in core shops, foundries and metalworking plants generally and in some respects they are superior to men." The latter might be considered quite an admission.

In February, H. Cole Estep told how "British Foundries Are Now Preparing for Peace." In March, an article "Paving the Way for the Guns" described foundry operations in the manufacture of cast parts of caterpillar tractors. The Liberty motor had attracted considerable interest, especially the speed with which it was developed and produced. An article in March entitled "Attaining Production on Liberty Motor Crankcase Castings" related a part of the history and described production methods of the Aluminum Castings Co. which maintained plants in Cleveland and Detroit and manufactured parts for that engine.

Navy Buys Cast Steel Chain

When the war so increased the demand for anchor chain that it became apparent the then existing methods of manufacture would not be sufficient to meet the needs, experiments were conducted with cast steel chain and the showing made was so favorable that later it was decided to adopt cast steel chain as standard for navy use. The National Malleable & Steel Castings Co., Cleveland, was one of the foundries making cast steel chain during the war, and an article in April entitled "Molding and Casting Heavy Steel Anchor Chain" described production methods at that plant.

Other articles covering war time operations included "Making Quad Wheels in a Tractor Foundry," a description of the Hart-Parr Co., Charles City, Ia.; "Inland Plant Sets Record on Marine Engine," a description of a record undertaking at the plant of Hooven, Owen, Rentschler Co., Hamilton, O., where James A. Murphy was superintendent; "Steel Castings for Our First Line of Defense," by Lieut. Walter S. Doxsey, now editor of *Daily Metal Trade*, another Penton publication.

Looking back over the year of 1919, it is interesting to note that activities of the editorial staff of THE FOUNDRY supplied numerous interesting news items. In the spring, A. O. Backert, editor of THE FOUNDRY and president of the American Foundrymen's association, visited England and France and through his contacts with foundry organizations and individuals in those countries, formed the foundation for international co-operation among foundrymen as it exists today.

The first of Pat Dwyer's reminiscences of the immortal Bill appeared in the February issue and was entitled "Bill Throws Some Light on Solomon's Temple." With the exception of Aug. 1 and Aug. 15, 1922, the feature has appeared in every issue of THE FOUNDRY since its initial appearance. This is one time, at least, when Bill was just a bit ahead of his favorite author, for it was not until two months after Bill made his debut that THE FOUNDRY announced that Patrick Dwyer had become affiliated with the editorial staff as associate editor. Later Mr. Dwyer became engineering editor, the position he now holds, and through his writings, talks and visits, has become one of the best known men in the foundry industry and an authority on practical foundry practice.

Pointers on Furnace Practice

In March of that year, H. E. Diller joined the staff as associate editor, later to be made metallurgical editor. When Mr. Diller died suddenly in 1924, after 20 years service in the technical field of the iron and steel industry, the foundry industry suffered a great loss. While Mr. Diller had been the author of several articles appearing previously in THE FOUNDRY, his first contribution after joining the staff was entitled "Pointers on Electric Steel Furnace Practice."

The year 1919 also found the name of Dan M. Avey, editor of THE FOUNDRY, appearing in the publication for the first time on a signed article. Mr. Avey for two years previous an associate editor, was the author of an article in the March issue entitled "Applying the Premium Plan to a Pattern Shop" and which described a system in operation at the Cleveland plant of the Westinghouse Electric & Mfg. Co. An article by E. C. Kreutzberg, now Eastern manager of the Penton Publishing Co., entitled "Eastern Plant Makes Ship Castings," appeared in August. The February issue carried an announcement that beginning with April 1, THE FOUNDRY would appear semimonthly.

Problems now confronting the industry were under discussion at that time. In the January issue, H. D. Egbert wrote on "Removing Foundry Dust by Electric Precipitation." E. S. Carman, in an article "How the Engineer Can Save Foundry Labor, urged foundrymen to pay closer attention to casting design as a means of increasing output. He also pointed to advantages in the use of molding machines.

Probably the most interesting development of the year was presented in an article "Molding Machine That Throws Sand." The article described a new device invented by E. O. Beardsley of Chicago and W. F. Piper of Oak Park, Ill. which employed the projectile principle of ramming sand. Since that (*Please turn to page* 48)

Fig. 6—The sand-slinging machine is used in producing all of the work on this floor

Control Features Steel Foundry

Detroit Steel Casting Co. exercises complete supervision over all variables

By FRANK G. STEINEBACH

COMPLETE control of all factors of production is a pre-requisite to the successful manufacture of steel castings. From the time materials are received at the foundry until they have become a part of the finished product or served their usefulness as aids in production, continual tests must be made to assure the utility of the material. Metallurgical and practical knowledge must be combined in solving numerous problems which constantly arise.

The management of the Detroit Steel Casting Co., Detroit, long has recognized the necessity for exacting supervision of all variables, and therefcre has established standards for materials and practices which permit the production of plain carbon and alloy steel castings adequate for a wide variety of engineering services. Every step, from suggestions on the proper design of the steel casting, to the shipment cf the finished work, is given individual attention.

Since the pattern is of prime importance, the company operates a modern pattern shop, where new patterns are produced for such customers as require that service, and repairs and alterations are made on patterns which are not satisfactory for service as supplied by the customer. All incoming raw materials are examined in the company laboratory. The sand in the two systems is tested hourly and a careful chemical analysis is made of each heat of steel. Physical and microscopic examinations are made regularly to check both steel making and heat treat-

Fig. 7—The bottom board rests on a rail and the mold is tipped to the position shown after pouring

ing processes. Research and experimental work constantly is under way to improve foundry practices and develop new alloy steel properties especially adapted to particular needs.

A clinic attended by the technical committee of the shop, which includes the superintendent, foremen and a representative of the laboratory, carefully considers each production problem before the pattern is placed in the sand. The committee decides whether it will be made in the large casting shop, or in the small casting shop, which was described in the January, 1933, issue of THE FOUNDRY. It also decides whether electric furnace or open-hearth furnace metal will be used to pour the castings, how the casting shall be gated and headed, and what precautions should be taken with external or internal chills.

Plan Work Well in Advance

Each afternoon the scheduling department and the inspection department, which represents the customers, meet with the superintendent and all foremen to plan the work of the following day, to check up on delivery promises and to consider any complaints or trouble. This is just a further step in the general scheme for production planning and control, and provides assurance that the customer not only will receive castings of uniform quality, but that the castings will be delivered at the time promised.

Fig. 8—Under normal conditions the heavy shop has a capacity of 700 tons of steel castings a month

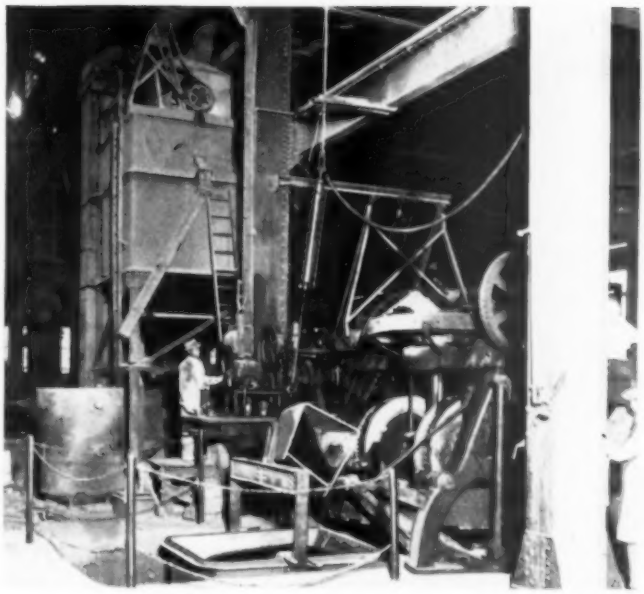


Fig. 9—Equipment for handling and preparing sand in the heavy castings shop

Along the same line, pattern records are made exceptionally complete to assist the various manufacturing departments. The order, coming from the pattern storage office, is made in quadruplicate, one copy going to the shipping department, a second to the cleaning department, a third to the foundry office, while the fourth is retained in the files of the pattern storage office. To supply an easy means of identification and thus facilitate the movement of the work through the plant, a drawing of the casting is made on the order.

Handles Materials Mechanically

As was the case in the small castings shop previously described, mechanical equipment is used extensively in the large castings foundry. Both cranes and roller conveyors are used to transport materials. Sand is handled mechanically from the shakeout through the reclaiming and preparation units and is carried by the crane to two different floors. Molds are made on machines, the castings are cleaned in room type sandblast equipment, ground with swing frame and stand type grinders, and the risers are removed by the cutting flame. A modern annealing oven, accurately regulated by heat control equipment was designed to meet the particular needs of the foundry. Application of the various types of equipment to the work of the foundry again permits a more uniform product and at the same time speeds production facilities.

Research work on sand problems has led the company to adopt a specification for the purchase of sand that places as much emphasis on the shape as upon the size of the sand grains. A sand which had proved entirely satisfactory in practice was examined under the microscope and photographs of the enlarged grains were

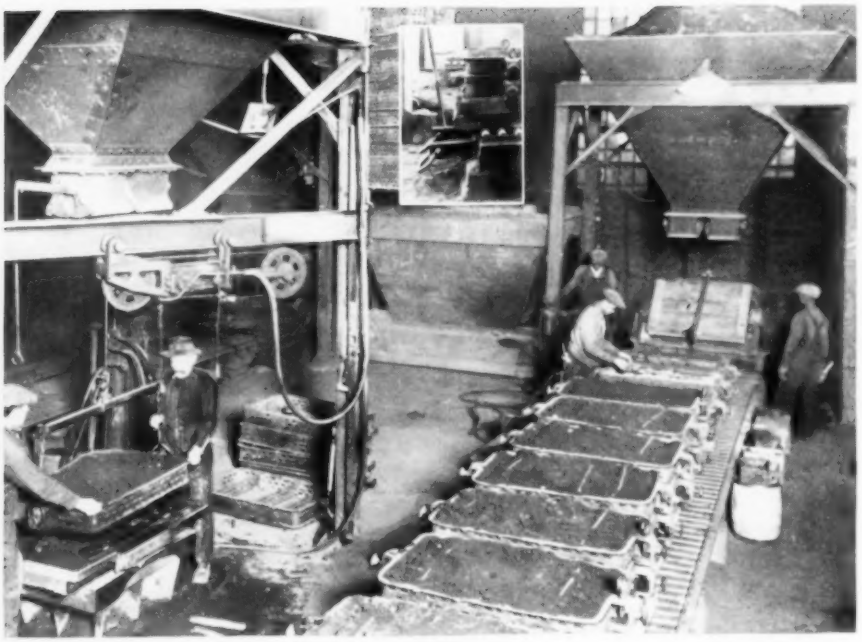


Fig. 10—Railway car parts, furnace castings, etc., are made on machines which are operated in pairs. Inset—End of rail carrier with hooks

made. Unless the grain shape corresponds closely to the standards, the sand is not accepted.

An angular grain silica sand is used for dry sand work and a round grain for green sand molding. The angular grain permits the sand and binder to pack to a greater degree, and thereby provides greater dry sand strength. The round grains provide the greater permeability necessary for green sand work. The mixture used for the facing sand consists of reclaimed silica sand, new silica sand when considered necessary, a fire clay and a cereal binder. Four to 4½ per cent moisture is used in green sand work.

Experiments and careful study of operating conditions have developed definite ideas regarding the necessary permeability of the facing sand and the backing sand. The management of the Detroit company believes that high permeability is necessary only in the backing sand, providing the facing sand consists of a thin, even layer over the entire pattern and the backing sand is exceedingly permeable. Of course, this practice permits the use of a much finer facing sand than has been the custom with many foundries in the past.

In completing this general discussion of sand problems, it is interesting to trace the path of the sand through the shop and to indicate the methods of handling. Sand is received in railway cars which may be spotted on a siding along one side of the large castings shop. The sand is unloaded by a locomotive type crane and dumped on a conveyor which carries it to a distributing conveyor inside of the plant. The distributing conveyor serves the various sand and clay bins.

Sand from the shakeout, which is located near the center of the floor between the two separate molding floors, which will be described later, is carried on a conveyor to an elevator, as shown in Fig. 9. The elevator discharges the sand on a screen which removes the lumps and refuse, and a dust arrester system built by the Pangborn Corp., Hagerstown, Md., removes the fines. In this connection it is interesting to note that the management does not believe that it is necessary to remove (*Please turn to page* 60)

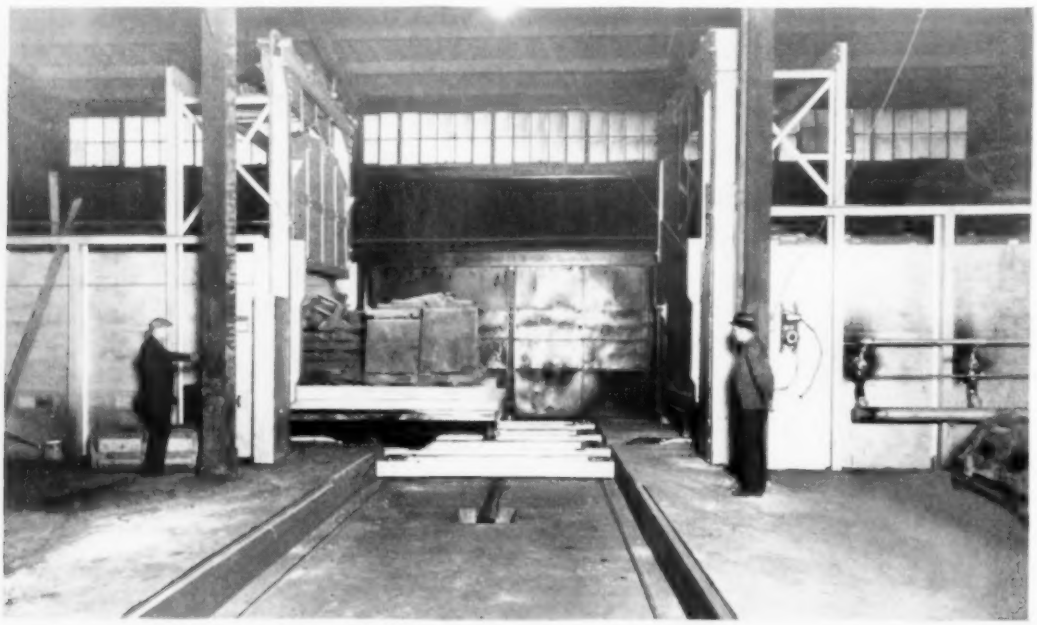


Fig. 11—A specially designed furnace is used to heat treat the castings in the heavy shop

Sees Radical Stand Necessary

Prices of castings must be based upon known costs and no castings sold below that level

IN CLOSING his term as president of the Steel Founders' Society of America, Arthur Simonson, Falk Corp., Milwaukee, stressed the need for a new viewpoint and higher ethics in all departments of business and government. He said:

"Along with our material deflation, we are coming to realize that with the years we have permitted our spiritual values to be deflated also, and today we find ourselves well along the road to bankruptcy in those fundamental virtures without which no nation can continue to prosper for very long. The erosion which has taken place in American life during the past three years has exposed a lowered standard of morale and morals and ethics, without which a nation cannct be truly prosperous or permanently great.

Reconstruction of Fundamentals

"You all know what I mean; the profligacy and waste in government, the corruption of politics, the futility of our statesmanship, the increasing national tendency to live beycnd our means, mortgaging the future, and failing to learn the lessons which the past should have taught us. These are major factors culminating in the present state of affairs, and these are the factors which will have to be corrected before we can get back to the middle of the high road leading to the glorious destiny which we all in our hearts believe to be the destiny of the American people. We need a thorough searching of our spiritual life and a reccnstruction of our fundamentals."

In spite of "crats, cults and ologies" which clutter the immediate foreground, the long view of America is unobstructed. President Simonson lauded the spirit which is emerging in the crisis.

With steel foundry operations reported as varying from 10 to 25 per cent of capacity, by members attending the annual meeting of the Steel Founders' society at Hotel Statler, Detroit, Jan. 19, a new attitude is apparent. It is apparent that a greater willingness to co-operate, to recognize the fundamental fact that business cannot continue with manufacturers selling below cost, and a definite feeling that 1933 will not be worse and may be much better, shapes the thinking of steel foundrymen.

Reports of special committees including that co-operating with the American Fcundrymen's association on the preparation of a cast metals handbook, and the technical committee demonstrated the continuity of effort along lines of improving product.

The tendency of large buyers and dominant industries to demand lower and lower prices was deprecated by the managing director, Granville P. Rogers in his annual report. Everyone has suffered as a result of prcfitless operation. Higher standards of business ethics, better selling and the assumption of responsibility by the society for leadership in merchandising was urged. Despite curtailed budgets, the society has fulfilled its responsibility with only a temporary recession from the program laid down in 1929.

Malcolm W. Bingay, editorial director, *Detroit Free Press,* in an address following the luncheon, pointed to the period as the end of an era. He dissected Technocracy in clever and amusing fashion and displayed its shortcomings from a newspaperman's view.

Castings Prices Are Ruinous

The ruinous effects of the downward spiral of steel castings prices was demonstrated by Frederick A. Melmcth, Detroit Steel Casting Co., Detroit. He ccntrasted the American steel foundry industry with that in England, where the depression came into being in 1921. There, prices have not been dropped to such ridiculous levels. A realization that no more business would be created by such practice has saved British fcundrymen from the fate that is overtaking many in America. The weight of enforced economy has reacted to constantly falling returns, less money is circulated in wages, less goods are manufactured, less commodities are transported. Steel foundrymen today would have no less demand with prices 30 per cent higher. A radical stand is necessary. Prices must be based upon known costs and no castings sold below that level.

Clarence Tolan Jr., (*Please turn to page* 61)

Effect of Alloys in Cast Iron

Chemical analysis more valuable adjunct to cupola operation than any other phase

By R. C. GOOD

Electro Metallurgical Co.

CARBON and silicon enjoy the leading position as influential elements in cast iron. They are responsible jointly for the condition of the casting with respect to hardness, machinability and structure. Individually, they regulate melting point, fluidity, ductility and solidity. In addition silicon acts as a precipitant on part of the carbon, throwing it out of solution during solidification in the mold in the form of graphite according to the concentration of both the silicon and carbon. Proportion of graphitic to combined carbon, size and distribution of graphite, control the general characteristics of solidified cast iron.

Solidification Time Is Important

Another principal variable that must be considered is the section size of the casting but a discussion of that variable is beyond the scope of this article. All that need be mentioned is the general law governing separation of graphitic carbon. As the cross section of the casting is increased, length of time for solidification also increases and permits a more complete separation of graphite. Conversely, as the section decreases the proportion precipitated decreases rapidly. Silicon may be employed definitely to modify that law. By increasing silicon it is a simple matter to cause precipitation of some carbon in extremely light sections providing there is the usual amount of carbon present.

Silicon has a strong affinity for oxygen and it often is used as a ladle addition to counteract effects of that gas. Unfortunately, the ordinary analysis for silicon does not indicate if the silicon is present as the silicide, in which case it is extremely active as a precipitant, or as the oxide. If present as the oxide, it is in effect exactly opposite to that of the oxide silicide and it has been known to cause what are called internal chills and may raise machining costs and lower the ductility of the casting.

Several years ago Piwowarski conducted a test to determine the effect of repeated melting in a cupola. Starting with a charge consisting of all pig iron of known analysis, it was melted repeatedly and the usual loss of silicon and manganese through oxidation was replaced with alloy additions in the ladle to maintain the composition. At the end of the fourteenth operation the iron, which originally had a gray fracture, was white, showing that part of the silicon had been oxidized and was no longer effective as a softening agent even though it existed in the same proportion as determined by the chemist. In a second test a fluxing agent was supplied in the form of soda ash to each melt. Instead of finding a white fracture at the end of the fourteenth operation, it was necessary to continue until the twenty-third.

There are several ways to prevent such reactions where large percentages of scrap iron are used. The blast pressure should be limited and the bed coke well maintained. The use of the flux is highly desirable and a forehearth may be employed to promote a better separation of iron and oxidized metal. Ladle additions of both manganese and silicon further assist in the separation of the iron and nonmetallic material by acting as scavenging agents.

Silicon Has Strong Influence

Silicon exerts a strong affinity on gases, a fact sometimes overlooked in the general operation of the foundry. Strong evidence of that characteristic was gained several years ago in a study on the gases held in solidified iron. When heated in a vacuum the amount of gases given off increased as the silicon in the iron samples was increased. Incidentally, the gases so held were mainly of a reducing nature which accounts for the lack of trouble from that source in the average foundry where oxidizing atmospheres prevail at the base of the cupola despite the presence of white hot carbon. This point is far more important to the operator of an electric furnace or the producer of the 14 per cent silicon grades of iron and compensating measures must be taken such as covering the metal with an oxidizing slag. Under exceptional and unusual conditions, manganese acts in an analogous manner, a point recently dis-

ccvered in the production of high manganese iron rolls.

It is the author's contention that control of chemical analysis is a more valuable adjunct to the operation of a cupola than any other phase, although this control is obtained by operating the cupola under known conditions. It is realized that considerable opposition to this feeling exists among foundry men today but there are so many variables in melting and casting iron that it seems more logical to study the effects of the elements found in iron and their combined effect rather than other variables such as pig iron quality, coke quality, air pressure, etc.

Introduction of special alloying agents is a futile gesture where they are not based on definite fundamentals. Why add an alloying agent unless the base iron is free from oxides or the carbon is known to exist in some exact proportion before the addition? Where the combined carbon in the iron is less than 1 per cent it will be found to exist as pearlite if examined by the microscope. Pearlite has a high tensile strength and good ductility. Some alloying elements intensify this constituent and perhaps change it to sorbite while others influence the strength or characteristics of the other constituents usually found in cast iron such as graphite and ferrite. The principal alloying agents commonly used in the foundry either separately or in combination furnish a tool for development of exceptional characteristics.

Gives Effect of Manganese

Manganese exerts a decided influence on strength and toughness of cast iron. Where cast iron contains a low silicon, more iron oxide will be found than in iron of a high silicon content and if manganese is added to the low silicon iron, it acts chemically on iron oxide and actually softens the metal. Above 0.70 per cent manganese, the manganese combines with carbon or sulphur but generally the former and develops a carbide that is more stable and resistant to heat than where the manganese is low. Recently foundrymen have learned it is advisable to hold the manganese around 1 per cent. One foundryman claimed the number of hot tears was distinctly diminished with these higher manganese percentages. With more than 1 per cent manganese the iron exhibits strong chilling tendencies. This sort of a chill is brittle and usually shows a larger grain. To compensate for this effect it is advisable to add along with the manganese some toughening agent as nickel or molybdenum.

Chromium is a popular alloy and imparts a definite influence on the structure of cast iron. In small quantities it usually unites with the carbon forming extremely hard carbides that resist abrasion and heat but the combination takes place at the expense of the graphitic carbon. It has also been learned that the size of the remaining graphite is much smaller than when no chromium has been used. An increase of chromium from 0.10 to 0.50 per cent will raise the hardness without any loss of ductility. However, above that point the hardness is increased while the ductility declines because the per cent of combined carbon is taken above the optimum range 0.80 to 0.90 per cent. This statement is based on the assumption that the cross section and base composition of the iron are the same in both cases.

Manufacturers of malleable iron have objected for years to presence of even minute amounts of chrome in their mixtures on account of its stabilizing influence on the carbides. Yet it has recently been proven that a high strength malleable iron may be made by simultaneously increasing the silicon with the chrome.

Chromium Increases Hardness

In the western states where large ore concentrating plants must reduce the size of their material to fine particles for efficient separation from gangue material, they use chrome-bearing chilled iron balls that are fed daily into the grinding mills. These usually contain from 2.00 to 2.50 per cent chrome and about 0.80 per cent silicon. A brinell hardness of 550 is obtained readily.

Resistance to highly oxidizing gases at high temperatures, such as may be met in dry door frames for heating furnaces, is obtained through use of higher percentages of chrome. Iron has been made in the cupola with from 15 to 25 per cent chrome for such heat resisting parts as stoker bars, thermocouple tubes, incinerator parts and in air furnaces for malleableizing boxes. Use of either an (*Please turn to page* 54)

Cupola melting is of primary interest to a majority of gray iron foundries

Deoxidizers for Brass Alloys

Yellow brass castings will not withstand pressure when aluminum additions are made

By CHARLES VICKERS

ALUMINUM or silicon, when used in yellow brass castings of high zinc content, will make nice appearing castings, but it is generally regarded that castings thus made will not withstand pressures, even the moderate pressures expected of fittings for plumbing fixtures. The metal is stronger than red brass, the castings are smooth, and while it is possible they are a little more difficult to machine, this is not an unsurmountable difficulty because the metal can be leaded. Cutting tools also can be shaped and ground so that machining presents no difficulties, even if the lead is omitted for any reason. In spite of this, the metal has been thought unsuitable for making fittings, because it is not pressure-tight.

For that reason a red brass was selected in place of a yellow brass for the fittings of yellow brass pipe. The only reason a red brass fitting casting is used to join a yellow brass pipe is merely because of the difficulty of casting a yellow brass fitting, and not because the red brass fitting is any better.

Opinion Is Prejudicial

Prejudice of workers also enters into the situation. Plumbers who work on these fittings have been so accustomed to using red brass fittings that they cannot seem to become accustomed to brass of a different color. While these people have nothing to do with the manufacture of fittings, their ideas must be considered, because their objections may erect a sales resistance difficult to overcome.

It is possible the situation may be due largely to the fact that in the past yellow fittings were inferior in soundness to the red fittings as yellow brass is notoriously difficult to cast. However, there are two kinds of yellow brass. One, which might be called the regulation type, such as is used in making yellow brass fittings and other castings, usually is limited to a maximum of 30 per cent zinc may contain tin and lead, and is free of aluminum. Another type of alloy, which is much stronger and harder, will contain 38 to 40 per cent or more of zinc. This is a very strong metal belonging to the family of the manganese bronzes and other strong alloys. The only difficulty is that it must contain aluminum or possibly silicon, otherwise it cannot be cast in sand molds. While the content may only be a few tenths of a per cent, nevertheless, it so greatly increases the tendency of the metal to oxidize and form dross, that it becomes difficult to produce pressure tight castings.

Silicon acts similar to aluminum, as far as increasing the fluidity of the alloy is concerned, but causes less shrinkage than aluminum. Silicon cannot be used successfully as a deoxidizer or fluidizer in leaded brass alloys, since the reaction between lead and silicon produces lead silicate, in the form of a voluminous gray, powdery dross, in the castings.

Counteracts Influence of Lead

As the result of experiments, it was found that the reaction between lead and silicon could be counteracted by adding aluminum to the 10 per cent silicon copper. The amount of aluminum necessary was roughly half the content of silicon. The alloy of 10 per cent silicon copper was remelted and 5 per cent of aluminum was added to 95 per cent of the alloy. Thus an alloy containing approximately 10 per cent silicon, 5 per cent aluminum and the balance copper was made and poured into ingots. These were brittle and could be broken up easily to make the weights necessary. Thus a silicon deoxidizer was produced for use in place of aluminum in high zinc yellow brass. It has some advantages over aluminum, as it does not cause nearly as much shrinkage as aluminum, even when only 0.10 per cent of the latter is used. The deoxidizer makes cleaner castings, free of the dross so often found on aluminum-treated castings. After the deoxidizer was developed it was hoped that leakers would be greatly decreased by its use.

A number of tests therefore were made. An alloy of yellow brass was weighed up with the idea of making each heat so near alike that a reasonable comparison would be possible. Heat No. 1 consisted of 65.31 per cent copper; 34.57 per cent zinc; 0.12 per cent aluminum; and no

lead. From this alloy 22 one-inch elbows were cast. After trimming, the ends of the castings were closed with rubber disks as usual for testing such castings. Water pressure was then applied in the same way as ordinary plumbers castings are tested for leaks. The test showed that two castings were good, 20 were leakers. The castings leaked at 30 pounds pressure. The character of the leak showed that the entire outer area near the point of gating was sweaty. Castings were a bright yellow, as is usual with aluminum-treated brass. This first test showed that even a nonleaded alloy of yellow brass, treated with aluminum, could not be depended upon to stand even moderate pressures.

The second test was made on a leaded alloy without any addition of aluminum or silicon. The alloy was as follows: copper 61.54 per cent; zinc 34.62 per cent; lead 3.84 per cent. Twenty-two elbow castings were made, 17 were good castings and 5 were leakers. All castings withstood 30 pounds pressure without leaks, 2 leaked at 50 pounds pressure, and 3 at 75 pounds pressure, the latter being the regular test for cocks and faucets, etc. The color of the castings was dull and muddy, and the castings were quite rough.

A third heat consisted of the following: Copper 62.96 per cent; zinc 33.33 per cent; lead 3.70 per cent; plus 4 ounces of aluminized silicon copper. Twenty-two castings were made, 3 were good, 19 were leakers. The castings leaked at 30 pounds pressure and the entire area was sweaty, with a decided leak near the gates. Castings were bright yellow and smooth. Outside of the leaks the castings would have been all good.

Leakers Still Encountered

A fourth heat was made using the same deoxidizer or fluidizer consisting of 4 ounces of aluminized silicon copper added to the following alloy: Copper 65.4 per cent; zinc 34.6 per cent; no lead, to determine if the lead was responsible for the leakers. Twenty-two castings were made, of which 7 were good, and 15 were leakers at 30 pounds pressure. Outside of leaking, the castings were good. They were of a light orange color, and very smooth.

A fifth heat consisted of the following: Copper 62.9 per cent; zinc 33.4; lead 3.7 per cent. It was treated, or deoxidized, with a proprietary alloy, known as a *yellow brass fluidizer*, which contained aluminum, iron, copper and phosphorus; 22 castings were molded, of which one was good, and 21 were leakers at a pressure of 30 pounds.

The sixth heat consisted of the following: Copper 61.5 per cent; zinc 34.6 per cent; lead 3.8 per cent. It was deoxidized with an alloy containing 2 per cent tin, 2 per cent nickel, about 2 per cent phosphorus and the remainder copper. This strength is about right for using phosphorus in yellow brass, if one per cent is added to the brass. The alloy was thus treated with one per cent of this reduced phosphor copper alloy, which also carried a little nickel. In all other respects the alloy was the same as those in the other tests. Twenty-two castings were made and all good. The pressure test was carried to 250 pounds per square inch, without showing any signs of leakage or sweat.

Copper used in all these tests was electrolytic, the zinc, was prime western. All deoxidizers were added to the melt 5 minutes before it was removed from the furnace. A new crucible was used for each charge. The content of zinc i the tests ranged from a little over 33 per cent to 35 per cent, or what is usually understood to be outside the range of easy castability of yellow brass alloys without aluminum. The second test proved this point, for while a greater number of castings that would hold pressures were obtained in this heat, the appearance was against them, and they would have been ruled out on that score.

About one ounce of 5 per cent phosphor tin added to 100 pounds of brass will give similar results to those recorded in the sixth test. This amount of phosphorus is a very good deoxidizer in the case of yellow brass, containing from 18 per cent to 35 per cent zinc.

Coin Name Silicon Bronze

Tests showed that an alloy containing 38 to 40 per cent or more zinc would not cast in sand molds with the aid of a small amount of phosphorus, so silicon was added instead, and the name silicon bronze was selected when the alloy had been perfected. The silicon bronze was 35 per cent stronger than red brass, and had some 30 per cent greater elastic limit. There are numerous alloys of silicon bronze, for silicon greatly resembles tin in its usefulness in alloy with copper.

Every one of these silicon yellow brass fittings was subjected to an air pressure of 100 pounds per square inch, equivalent to a hydraulic working pressure of 300 pounds per square inch as air penetrates metal 6 times as readily as water.

The alloy used in the silicon brass fittings was made by melting 59 pounds of copper under suitable flux, and when it was molten stirring into the copper 1½ pounds of 10 per cent commercial silicon copper. The copper again was well stirred and 38 pounds of zinc was added in much the same way as making manganese bronze. After that was thoroughly amalgamated 1½ pounds of 50 per cent ferrosilicon was stirred into the melt, a suitable flux being used to help the iron and silicon into sclution. After this addition, the metal was covered with charcoal and superheated for a period of 10 minutes, and was then cooled to pouring temperature with gates.

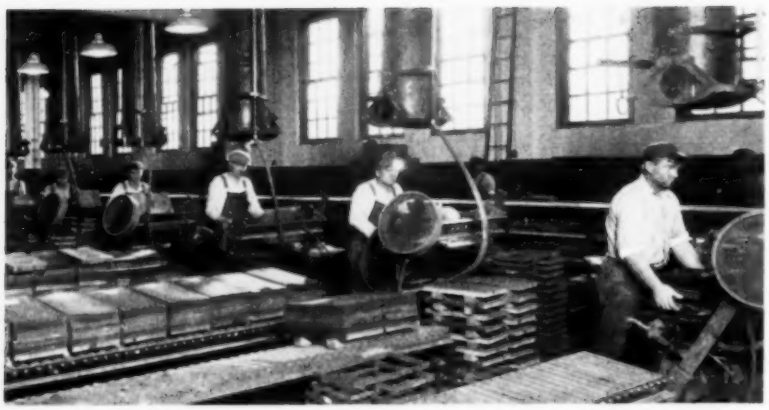


Fig. 1—General view of the molding bay showing arrangement of mold conveyors and machines

Handling Materials in a Brass Shop

Western Electric Co. reduces costs with handling equipment and electric furnaces

By D. G. ANDERSON
and
B. F. McAULEY

A RECENT trend in foundry practice, as in numerous other industries, has been the development of equipment to speed production by improvements in materials handling methods. There are few foundries exactly alike, yet there are many foundries which are faced with the problem of installing improved equipment to reduce costs and meet present-day competition. However, equipment must be applied correctly to the local conditions existing in each particular foundry.

The brass foundry at the Hawthorne works of the Western Electric Co., Chicago, is devoted to production of nonferrous castings required in telephone equipment. It occupies an area of 75 x 125 feet in a wing of the main foundry, and its normal capacity has been doubled within recent years by the introduction of new equipment.

The majority of the individual castings made in it are small and of a wide variety of design. Accordingly, it can be considered in the small or jobbing foundry class.

While such a small foundry does not lend itself as readily to mechanical handling as do larger foundries which are laid out on a basis of heavy production schedules, it has been found that the introduction of more efficient equipment with the improved sequence of operations has been justifiable.

Shakeout sand is dumped through protected openings in the floor onto an 18-inch rubber-covered conveyor belt which carries the sand to the boot of an enclosed elevator. The returned sand is carried upward by a standard bucket elevator with buckets mounted on a rubber-covered belt, and discharged onto a vibrating screen. The screen cloth has a diagonal mesh of ¼ x 1-inch which permits the sand to flow through it into a storage hopper. Cores and bits of metal are discharged over the screen

Fig. 2—Alternate molds on the storage line are poured and the weights then placed on adjacent molds

into a container located on the floor.

From a measuring hopper of 10 cubic feet capacity, located at the bottom of the storage hopper, the used sand is discharged into a mulling type sand mixer. Here both water and new sand are added to bring the sand to its proper consistency for molding. Water is added by gravity flow from a small measuring tank. The relative moisture is determined by an electrical resistance moisture-meter installed on the mixer.

After mixing approximately 3 minutes, the prepared sand is discharged on a table-feeder located in a pit under the mixer. The table-feeder has a raised conical section at the center. This tends to throw the sand against a fixed retaining plate around the circumference of the table as the latter rotates.

There is an opening between the table feeder and the housing through which a plow is inserted to scrape sand off the rotating table. The rate at which sand is discharged from the table-feeder is regulated by the setting of the plow. This feature permits continuous feed from the table as the plow deflects the sand to a bucket elevator from which it is discharged into an aerator. In passing through the aerator, the sand is thrown at high velocity through a series of wire brushes that break up any small lumps which may be present. The sand is light and fluffy when discharged from the aerator to the flight conveyor.

The aerated and conditioned sand is conveyed to the molding positions by a double-deck drag conveyor 15 inches wide and 7 inches deep, with flights spaced on 18-inch centers. The flights are carried on a roller chain that runs on light rails. At the operating speed of 40 feet per minute, the capacity of the conveyor is 25 tons of prepared sand per hour. The flights travel in built-up rectangular troughs open at the top.

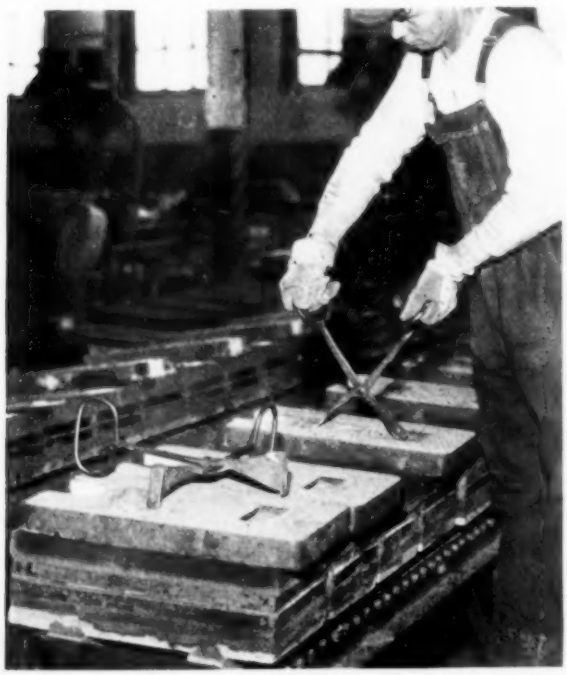


Fig. 3—Tongs are used to shift the hot weights

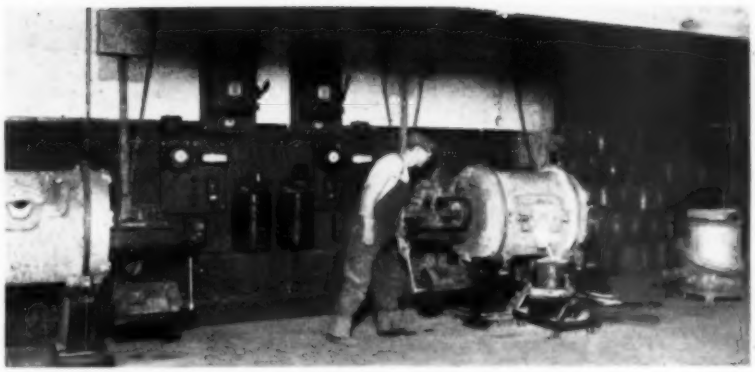


Fig. 4—Arrangement of melting units, control board and crucible mounted on small dolly

Sand from the aerator is carried in the upper trough to the far end of the conveyor, where it is dumped over the take-up end into the lower trough. The molders' hoppers are filled automatically as the flights in the lower trough pass over openings leading to them. Three of the flights are fitted with rubber tips to keep the conveyor free of any sand that may accumulate and dry out.

Bins Larger at Bottom

The molders' hoppers are circular, with a diameter of 14 inches at the top and 16 inches at the gate. This prevents the sand from sticking in the hoppers and insures a positive flow whenever the discharge gate is open. A view of molding positions is shown in Fig. 1.

Deflectors are mounted beneath the gate to direct the sand into the center of the flask on the molding machine below. The entire construction of the hopper eliminates waste time due to clogging sand and unnecessary spillage.

The completed molds are placed on roller conveyors of the lateral-slope type. Unprotected molds made in snap flasks are used exclusively. Ordinarily, molds are contained in flasks when moved on a roller conveyor; but experiments proved that unprotected molds could be conveyed successfully by employing protecting contacts, that is, cleats on the bottom board which protect approximately one-half inch, making a separation of one inch between molds.

The flask sizes are selected to produce the maximum number of good castings per day. This usually is not the largest flask or the pattern design that produces the greatest number of castings in one mold. Large flasks cause fatigue, and small patterns grouped close together frequently cause the separating sand walls to fracture when the pattern is drawn.

We have found by experience that the largest mold which can be used economically is 10 x 18 inches with 4-inch *(Please turn to page 62)*

Questions and Answers

Covering important problems found in all phases of modern foundry practice

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the following advisory staff: Steel, John Howe Hall; Malleable, H. A. Schwartz; Gray Iron, John W. Bolton; Nonferrous, N. K. B. Patch

Rigging Required for Manufacture of Brakeshoes

We shall appreciate any information on the manufacture of brakeshoes, approximate weight, iron mixture, size of flasks and daily output per man.

Most brakeshoes for the railroad rolling stock of this country apparently are made by one firm operating a number of foundries which controls the methods of manufacturing and applying the various styles of steel inserts designed to improve the life, the safety and the traction quality of the shoes. Some inserts are formed from several thicknesses of steel mesh while others are quite elaborate and are stamped from steel plate, afterward heated and bent to the required shape under a punch press. The former is employed in shoes designed for passenger car service. Heavy steel plates are placed in locomotive driver shoes.

Conditions of manufacturing vary to some extent in different plants, but the following procedure in one plant is fairly typical: Driver shoes are the largest and are cast singly in individual flasks. In addition to the steel plate attached to the cope side of the mold, a number of hard, crucible steel inserts are placed in the drag. Two nails are driven into the sand to hold the piece of steel nearest the gate, but the others retain their place through gravity. The steel plate is oiled and dusted with silica flour and suspended by wire from two rods which serve as bars in the cope. Small patterns are mounted in pairs with plain cope patterns and stripping plate drags. One man works on each floor and makes from 70 to 100 molds. Scrap brakeshoes, grates and other railroad scrap make up the greater part of the cupola charge. The resulting iron conforms to the following approximate analysis: Silicon 1.40 per cent; sulphur 0.08-0.10 per cent; phosphorus under 0.50 per cent; manganese 0.50-0.70 per cent; total carbon 3.25 per cent.

Lost Wax Process Is One Requiring Much Skill

While it is true that the best article on the lost wax process is that published in the February, 1911 issue of THE FOUNDRY, there are several points on which I would like enlightenment. For example, the author does not state the proportions of brick powder and plaster to be used. I find that if I do not char the mold thoroughly, the traces of wax cause the metal to boil, and if it is charred, then the metal burns on the plaster. Can you tell me the proper procedure?

Production of casting by the lost wax process, like many other methods requires some skill and knowledge which usually is gained through experience. The article you mention has enabled many foundrymen to produce castings by the lost wax process as the directions given are quite explicit. However, a certain amount of ingenuity will have to be displayed to fill in some points that are not given in detail. For example, one or two experiments will indicate the proportions of brick dust and plaster because if the mold is too weak, more plaster is needed. For a start it is suggested that you try 1 part of plaster and 2 parts of brick dust with enough water to give the proper working consistency which means liquid enough to pour, but not too sloppy. Carborundum firesand can be substituted for the brick dust.

In melting out the wax pattern, the mold is heated slowly with a gradually increasing temperature. That allows the wax to liquefy and run out through the ducts provided for that purpose. Then the temperature is increased to about a cherry red to insure that all the wax is driven out, and that the mold is bone dry. The mold is allowed to cool slowly and poured while still warm. If allowed to become cold there is a possibility of moisture being absorbed. We cannot

account for the bronze burning on the plaster unless it is because you did not allow the mold to cool down sufficiently or are using a metal mixture high in phosphorus which has a tendency to search out minute interstices and flow into them.

Wants Information on Producing Cupola Malleable

In melting malleable iron in the cupola, what analysis is anticipated at the spout. Is the annealing practice for cupola malleable iron similar to that for metal melted in the air furnace?

Raw material for cupola malleable iron castings is similar to the material melted in the air furnace, but the proportions vary to some extent depending on the class of castings produced in any given plant. In a prominent plant producing cupola malleable iron pipe fittings, a typical mixture is as follows: Low phosphorus pig iron, 15 per cent; steel scrap, 35 per cent; remelt and sprues, 50 per cent. Definite amounts of ferrosilicon and ferromanganese are added to the charges. The amount is based on experience checked by test bars taken at 6 minute intervals while the furnace is in operation. As cast, the iron conforms approximately to the following analysis: Carbon 2.80 to 3.10 per cent, silicon 0.70 to 1.10 per cent, manganese 0.40 to 0.60 per cent, phosphorus under 0.20 per cent, sulphur 0.15 to 0.25 per cent. After the castings are annealed the carbon content will show between 2.50 and 3.00 per cent.

Annealing practice for cupola melted malleable iron castings is similar to that pursued with castings made from air furnace iron. The temperature of the annealing furnace over a period of two days is raised to between 1550 and 1600 degrees Fahr. This means that all the castings in the furnace have arrived at this temperature. This temperature is maintained for from 48 to 60 hours, depending on the character of the castings. At the end of the period the temperature is lowered at a rate of not more than 10 degrees per hour until the temperature reaches 1275 degrees Fahr. The furnace doors then are opened, the pots are removed and are unloaded as soon as the temperature permits men to handle them.

Cast Iron Rolls Show Blowhole Defects on Surface

We are making roll castings 11 inches diameter, 40 inches in length with a 3½-inch square steel shaft in the center. The first nine castings were perfect, but later we have had several with blowholes on the surface and are at a loss to account for this form of defect. The mold is made in our regular dry sand mixture, well vented and dried thoroughly. The shaft is pickled to remove any scale or rust and then oiled. After the mold is assembled a gas hose is employed to remove any tendency toward dampness. The face of the mold is washed with a silica base blacking. The metal is melted in the cupola where chromium is added in the form of briquets. A molybdenum addition is made in the ladle. The temperature is checked by optical pyrometer and the metal is poured at approximately 2550 degrees Fahr. The castings are perfectly clean on the outside and show no evidence of impurities, shrinkage or segregation on the inside when broken. We have tried gating them top and bottom, but without any improvement.

Apparently some detail has been changed in the routine production of the roll referred to in your inquiry. If the first nine rolls were perfect, it would appear that your methods, materials and equipment are entirely satisfactory. To find the cause of the trouble in rolls made later you will have to check each item in turn and pursue a policy of elimination. The most probable offender is the shaft. The least hint of rust or scale will cause a commotion in the molten iron and this commotion will result in forming trapped gas bubbles. Sandblasting or grinding will produce a cleaner shaft than pickling.

From the small number of bubbles reported it is apparent that the commotion is not excessive. A flowing stream of iron will carry them away. To this end, place a whirl gate at the bottom of the mold and pour the metal rapidly. Your present method of gating encourages the retention of bubbles if any are formed. The metal

Main entrance to the famed Trinity church in the heart of New York's financial district, showing massive cast bronze doors and the tympanum. Six panels depict the artist's conception of scenes from Biblical history. Illustration supplied through courtesy of the Bulletin of the Copper & Brass Research association

falling as it does in two streams close together, allows a skin or film to form over the remainder of the iron in the mold. This skin prevents the free escape of any gas evolved by the shaft. Instead of two gates, place a ring of eight ½-inch diameter pop gates on the top and omit the riser.

Aluminum Plates Contain Many Defects

We are making aluminum pattern and matchplates. Sometimes we have trouble with the pattern plates as they are full of holes. The holes appear to be blows as the surfaces around them are smooth and bright. The castings are made in a good grade of aluminum molding sand and gated on the side through four gates poured through a single sprue. Risers are taken off the opposite side with a head about twice the size of the sprue. We melt in an oil fired furnace using an iron pot holding approximately 75 pounds of metal. Our melt consists of 75 per cent No. 12 remelt and 25 per cent of a good grade of scrap such as old patterns, driers and automobile crankcases. The metal is fluxed in the pot with a proprietary flux, dipped out and poured from hand ladles. The pouring temperature of the metal is judged by eye and the feel of it when stirred lightly with a skimmer. We judge it to be about 1100 degrees Fahr.

Examination of the piece of the casting forwarded to us leads us to the opinion that the holes are caused by the sand condition. In other words, the holes may be due to hard ramming, improper tempering which allows some portions of the sand to be wetter than others, insufficient venting, or poor mixing which allows balls of sand to form. Just which one of those conditions is causing the trouble will require some investigation on your part.

In addition to the self-evident holes, we notice that the metal also contains some inclusions which may be due to careless skimming or to the method of handling the molten metal. We notice that you mention the use of a proprietary flux, and suggest that when stirring the metal that you disturb the surface of the molten metal as little as possible. Otherwise, the oxide skin formed on the surface may be carried into the molten metal and form inclusions. Your method of handling the molten metal by dipping it out from the melting unit is a constant source of trouble from inclusions because the surface skin must be broken at each dip, and carried into the metal.

Less trouble will be encountered from such inclusions if the metal is poured from the iron pot into the pouring crucibles. Also, it is suggested that in pouring molds, the pouring crucible lip be held as close as possible to the opening of the sprue.

While you state that the pouring temperature of the metal is judged to be about 1100 degrees Fahr., your attention is called to the fact that the No. 12 alloy melts at 1175 degrees Fahr. Consequently, it will pay you to purchase a pyrometer so that you will know what the exact temperature is. You probably will find that a suitable pouring temperature for your work is around 1225 to 1250 degrees Fahr.

Charles Vickers 1865-1933

CHARLES VICKERS, 67, nonferrous editor and member of the advisory staff of The Foundry for many years, consulting metallurgist and widely known throughout the foundry field for his contributions, practical, oral and literary, to the industry, died Jan. 19, at General Hospital, Buffalo, following an illness of several months.

As with many prominent men in the foundry industry most of his early knowledge was gained through hard knocks and practical experience at a period before scientific knowledge was available. He was a member of a pioneering generation constantly attacking new problems and seeking explanation of the many phenomena peculiar to the industry to which he devoted his entire time and talents.

An instance of this insatiable curiosity, the student's desire to understand the basic principles underlying the behavior of metals and materials employed in the melting and molding processes, is shown in two reminiscent articles from his pen Make Early Steel History in Milwaukee, published in the Jan. 1 and Jan. 15, 1932 issues of The Foundry. The greater part of his life was devoted to the nonferrous metals, but he had considerable experience also in the gray iron and steel branches of the industry. Always an earnest student of foundry technical literature, he contributed voluminously from his own store as contributor, associate editor and nonferrous editor of The Foundry, contributor to other technical publications, correspondence as metallurgical consultant and as author of Metals and Their Alloys.

He was born in the village of Old Whittington, near Sheffield, England, and a short time later while living in New Whittington he attended a school maintained by the Stavcley Works Co., at Barrow-on-hill. Later the family moved to Dronfield where he attended the board school until he was between 11 and 12 years old. The family then moved to Bilston near Birmingham where the boy entered a factory as a hand punch press operator. His career in this field was interrupted by another family move to Lincoln, where the family fortunes mended and his father became an influential citizen.

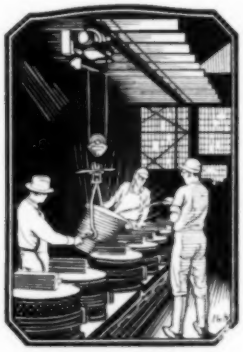
Charles Vickers

With characteristic independence young Charlie apprenticed himself in the brass foundry of Clayton & Shuttleworth and after remaining there four years, entered the employ of Ruston Proctor & Co., where he saved enough money by the time he was 23 to take him to America. His first job was an iron molder at the Capitol Iron Works, Topeka, Kans. In the following year he moved to Milwaukee and worked for the Filer & Stowel Co., and later the Milwaukee Brass & Copper Works. During this period he also had the steel foundry experience to which he refers in the articles quoted. He went to Chicago in 1896 and returned to Milwaukee in 1905 as foreman of The Milwaukee Electric Railway & Light Co., brass foundry.

Mr. Vickers began contributing articles to The Foundry in 1898 and in 1910 resigned his position in Milwaukee to become associate editor of The Foundry. Three years later, in 1913, he was appointed metallurgist the Titanium Alloy Mfg. Co., Niagara Falls, N. Y. He remained with this company until April, 1917 when he resigned to establish his own business as a foundry consultant in Buffalo.

Viewing Foundry Developments

At Short Range



A PROCESS has been developed for making castings with a chromium-nickel or chromium exterior, and plain carbon steel or gray iron interior. It is said that in the manufacture of the castings that the face of the mold is sprayed with water glass, and then powdered chromium-nickel or chromium is blown on. That is continued until a coating of the proper thickness is built up. The face is dried thoroughly and then the molten steel or gray iron poured in.

• • •

One foundry that makes castings varying considerably in weight has made it a practice to mold those of thin section close to the cupola, and the heavy castings farthest away from it. That practice is the result of a careful survey on proper pouring temperatures for various castings, and the temperature drop of the molten metal from the cupola to the pouring station.

• • •

RESEARCH has shown certain alloy steels can be hardened appreciably by cooling to low temperatures. Tests were made mainly on chromium-nickel, nickel-silicon and other corrosion resisting steels. Not only were the alloys hardened without discoloration but unusual physical and corrosion resisting properties developed. The machinability of the metals also was improved in some cases by the methods. Temperatures of 112 degrees Fahr. were used.

• • •

In applying porcelain enamel to gray iron castings, one manufacturer ran into a series of soft spots in the surface of the castings which an examination showed to be lead. At first it was thought that these lead spots were coming from the enamel, but further check indicated they were in the iron and were traced directly to the type of scrap used. It was found the company was using a heavy scrap containing a number of babbitt bearings. It was thought the lead in the bearings would not come through the cupola with the iron, but in this case it did.

• • •

Chromium plating the interior surfaces of core boxes to be used with blowing machines has been found to decrease the wear on the box due to abrasion of the sand and to facilitate greatly the removal of the finished core from the box.

• • •

TO OBTAIN hot metal with a low percentage of coke, a foundry has evolved a method to take advantage of bessemer converter reactions with relation to the silicon. By employing pig iron with around 4 per cent silicon, a low amount of coke, and proper regulation of the blast, good hot iron is said to be obtained. While the coke splits are small, the additional heat required is obtained at the expense of burning out the silicon in excess of that desired in the final castings. It would be interesting to know whether the saving in coke is greater than the loss in pig iron through the removal of the excess silicon.

• • •

Specially developed alloys are used in the construction of fish canning machines to prevent contamination of the food products which come in contact with the metal. Parts of the machine touched by the fish are made of nickel cast iron and the frames and other cast parts are made of a nickel-copper-chromium iron. Both types of castings are highly resistant to corrosion.

• • •

A torch designed for outide service such as road obstruction markers or to light night labor, recently introduced, is made entirely of gray iron castings. The unit is advertised as having a strong, rugged construction which makes it practically unbreakable and able to withstand crushing loads. Also, it does not tip over, and may be hung by a handle or set in place.

• • •

INTEREST in special grades of pig iron for foundry service has led to experiments on production of pig iron by remelting scrap with ore and alloy additions in foundry cupolas. The product is to be marketed as of satisfactory analysis for producing special type castings.

• • •

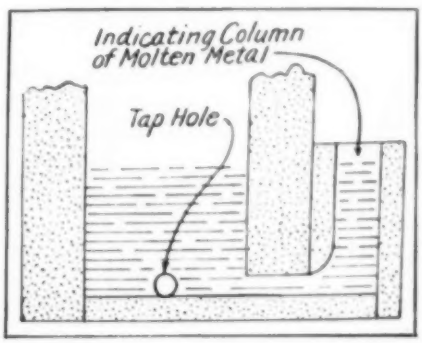
A new type pipe connection clamp for bell and spigot cast inon pipe made in several pieces and held together by bolts has been developed by a malleable foundry interest. In addition to the clamp all the bolts employed, which are of special type, are cast of malleable iron.

• • •

Thermos servers now are being die-cast of zinc, finished in chrome and silver plate and sold at prices which expand old market possibilities.

• • •

A German foundry has devised an indicator to determine the height of the molten metal in the hearth of



the cupola. The accompanying illustration indicates the design of the instrument. No detrimental influences of any kind have been noted.

The FOUNDRY Family Photograph Album

© Bachrach

Upper Left

T. H. HARVEY

Ohio Steel Foundry Co., Lima, O.

Upper Right

A. C. HIGGINS

Norton Co., Worcester, Mass.

Lower Left

F. J. KING

Linde Air Products Co., New York

Lower Right

CHARLES WEISS

Thatcher Co., Garwood, N. J.

Men of Industry

Whose Activities Are Making Foundry History

NATHANIEL K. B. PATCH, secretary, Lumen Bearing Co., Buffalo, has been appointed to the advisory staff of THE FOUNDRY, effective Feb. 1. Mr. Patch's long experience and far-reaching knowledge of nonferrous casting practice will be available in an advisory capacity with particular reference to the question and answer service of THE FOUNDRY devoted to nonferrous foundry problems. In this work he succeeds Charles Vickers, long associated with this publication, who died in January.

Mr. Patch received his elementary education in the schools of Buffalo and completed his scholastic work at the Massachusetts Institute of Technology, Boston. He has been employed by the Lumen Bearing Co. continuously since the organization of that firm in 1901. He was a salesman for 4 years and then was made manager of the Canadian plant of the company. Later he was promoted to the position of general superintendent and later, works manager of the Buffalo establishment. Since 1923 Mr. Patch has been secretary of that company.

Due to his prominent identification with technical organizations and his attainments along metallurgical lines Mr. Patch is known and respected throughout the industry. He was one of the organizers of the American Brass Founders association, was one of the first directors and served as president of that organization in 1911. His long history of activity with the various technical committees of the American Foundrymen's association led to his election as a director of that organization in 1926, vice president in 1929 and president in the period 1930-1931. He is a member of the American Society for Testing Materials and was chairman of the committee on nonferrous metals of that organization. He also is a member of the American Chemical society, the American Electrochemical society, the Institute of Metals (British), the Institute of Metals division of the A. I. M. M. E., and the Buffalo Engineering society.

In addition to Mr. Patch, the advisory staff of THE FOUNDRY, editorial department, is now comprised of John W. Bolton, Lukenheimer Co., Cincinnati; John Howe Hall, Taylor-Wharton Iron & Steel Co., High Bridge, N. J.; and Harry A. Schwartz, National Malleable & Steel Castings Co., Cleveland. Each of these men is recognized as a world authority upon the individual phase of casting manufacture in which he specializes.

N. K. B. Patch

THEODORE H. HARVEY, (see Family Album opposite page) recently elected president and director of the Steel Founders' Society of America, is vice president in charge of sales of the Ohio Steel Foundry Co., Lima O. Mr. Harvey was born in Ashtabula county, Ohio, in 1888 and graduated from Oberlin college, Oberlin, O., in 1910. During the following year he taught physics and chemistry and coached the football team in the high school at Waukesha, Wis. He then entered the manufacturing business, first as shop superintendent and later as traveling salesman, for a company specializing in portable houses and camp furniture.

Later he became connected with the First National Bank of Milwaukee. While with that organization he made his first contact with the steel castings industry when, as a representative of the bank he assisted in the liquidation of the Prime Mfg. Co., Milwaukee. The great demand for steel castings, occasioned by the war, led him to assist in the organization of the Pelton Steel Co., Milwaukee, in 1916, and for the next 2 years he was general manager of that company. In 1918 he was made works manager of the Springfield, O., plant of the Ohio Steel Foundry Co. For the past 6 years he has been at the headquarters of the company at Lima as vice president in charge of sales, and recently he also was made secretary and treasurer. Mr. Harvey has been a member of the Steel Founders' Society of America for the past 15 years, and has taken an active part in the work of that organization.

CHARLES WEISS (see Family Album, opposite page) recently was appointed general superintendent of plants No. 2 and 4 of the Thatcher Co., Garwood, N. J. Mr. Weiss began his foundry career in 1895 when he learned his trade as a metal patternmaker in Budapest with Albert Reich Co., makers of stoves and boilers. He came to the United States in 1906 and began work with the I. J. Miller Stove Co., Milwaukee, as a metal patternmaker. In 1908 he became connected with the Sodemann Heat & Power Co., Edwardsville, Ill., and in 1910 he accepted a position as patternmaker and trouble man with the American Radiator Co., Litchfield, Ill. In 1913 he was associated with the J. H. McClain Co., Canton., O., and 2 years later became connected with the Atlantic Radiator Co., Huntingdon, Pa. He then became superintendent of the Monitor Bi-Loop Radiator Co., Lancaster, Pa., and later was associated with the Central Radiator Co., Lansdale, Pa. In 1927 he became connected with the Thatcher Co., and for the past three years has been superintendent of Plant No. 4 of that company.

MARVIN B. KLATTENHOFF, recently resigned his position with the General Iron Works Co., Denver, because of ill health and now is located at 504 West 41st street drive, Los Angeles. Mr. Klattenhoff served his apprenticeship with the Stearns-Roger Mfg. Co., Denver and Pueblo, Colo., as a patternmaker. From 1894 to 1907 he was connected with the Excelsior Iron Works.

Leadville, Colo. Since 1907 he has been connected in an executive capacity with the following companies: Stearns-Roger Mfg. Co.; Baker Iron Works, Los Angeles, Union Iron Works, San Francisco; and the General Iron Works, Denver.

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HOWARD CONLEY, president, Walworth Co., Boston, recently was elected president of the American Standards association.

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A. G. HOUGH, vice president, Wiard Plow Co., Batavia, N. Y., now is also treasurer, succeeding Mrs. N. P. Bosworth, who has been treasurer since 1903.

^ ^

J. H. LANSING, works manager, Danville Malleable Iron division, Allith Prouty Co., Danville, Ill., has been made chairman of the Malleable division of the American Foundrymen's association, succeeding FRANK M. ROBBINS, Ross-Meehan Foundries, Chattanooga, Tenn.

^ ^

L. M. JOHNSTON, Pittsburgh, was reelected president of the Keystone Driller Co., Beaver Falls, Pa., recently when the board of directors met for reorganization following the annual stockholders' meeting. E. C. REBESKE, Beaver Falls, Pa., was re-elected vice president and CHARLES T. SMITH, treasurer.

^ ^

DAVE M. WHYTE has been made superintendent of foundries and pattern shop of the Cooper-Bessemer Corp. succeeding P. L. Livingston who has resigned. Mr. Whyte has been connected with the C. & G. Cooper Co., Mt. Vernon, for the past 10 year and has been at the Grove City plant of the Cooper-Bessemer Corp. for the past 18 months.

Equipment Maker Cuts Public Expenditure

H. S. Simpson, president, National Engineering Co., Chicago, as alderman in the city of Evanston, Ill., has been active in bringing about marked economy in public expenditures. As chairman of the finance committee of the city council, Mr. Simpson has been devoting attention to budget reduction. In consequence the 1933 tax levy for Evanston is approximately $847,270, a reduction of $510,000 from the tax levy of the preceding year. The original tax levy for the city in 1931 was $1,562,-367. This, however was reduced as was the 1932.

Commenting on the appropriations and probable tax levy for next year, Alderman Simpson said:

"These figures are significant as showing the work done by the present city council in co-operation with the mayor to bring about a very satisfactory reduction, not only in the budget itself but, what is more important, in the tax levy ordinance, which, of course, will directly affect the amount to be paid by the taxpayers when the 1933 tax bills are sent out."

Chicago Club Hears General Hammond

Gen T. S. Hammond, president of the American Foundrymen's association and of the Whiting Corp., Harvey, Ill., addressed the Chicago Foundrymen's club at its regular monthly meeting Feb. 2. The occasion, known as past president's night, was attended by about 40.

Among former presidents of the Chicago Foundrymen's club present who spoke briefly were George Fisher, Harvey, Ill.; Oliver Goldsmith, W. D. Allen Mfg. Co., Chicago; and C. L. Larson, Armour Institute of Technology, Chicago. Other speakers included S. T. Johnston, past president of the American Foundrymen's association, Frank D. Chase, Frank D. Chase Inc., Chicago, and C. E. Hoyt, executive secretary of the American Foundrymen's association. Mr. Hoyt gave a resume of the history of the various Chicago foundrymen's groups leading up to the present organization.

General Hammond in his talk emphasized the value of foundry club meetings, particularly under present conditions which necessitate substantial operating economies. In pointing out the strength of organized minority groups, the speaker detailed the large governmental expenditures resulting from legislation promoted by such bodies.

Good foundry housekeeping will be the general subject of discussion at the March 2 meeting of the Chicago Foundrymen's club. E. O. Jones, Belle City Malleable Iron Co., Racine, Wis., will be the speaker.

Index Is Ready

AN INDEX of all articles published in THE FOUNDRY during 1932 and giving a complete reference and cross reference to the material which has appeared in each of the issues, has been prepared for distribution. Readers who bind or preserve the back issues of this publication will find the index of great value in referring to articles which have been published. A copy of the index will be mailed free of charge to any subscriber who requests it from THE FOUNDRY, Circulation Department, Penton Building, Cleveland.

Malleable Club Continues Estimating

Realizing the fundamental importance of the subject of estimating the weight of castings from the blue print, the Malleable club, Milwaukee, has been endeavoring to bring out as much information as possible on the most accurate way to make the estimate. The regular meeting of that group held Jan. 10, was devoted to the problem of making the estimates. Methods of estimating used by the Belle City Malleable Iron Co., Racine, Wis. were demonstrated. G. M. Goepfert of the Belle City company spoke briefly regarding the fundamental importance of the subject to every jobbing foundryman and introduced Mr. Weberg of the same company, who discussed thoroughly the methods of estimating weights, illustrating his talk with prepared diagrams of castings.

Charles Hintz, Badger Malleable & Mfg. Co., South Milwaukee, Wis., led the discussion of the blue print that had been estimated by the members for that meeting.

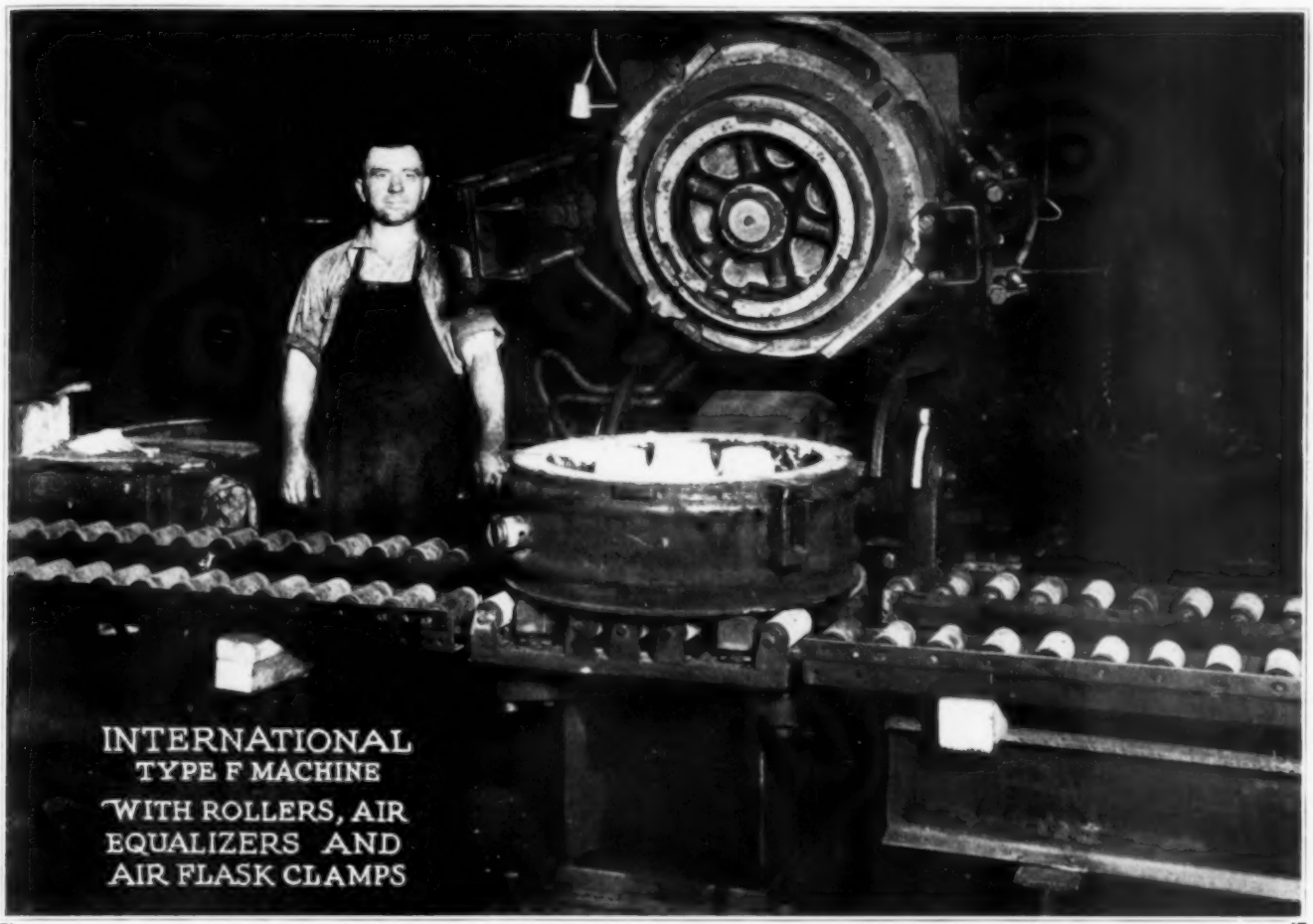
Plan Meeting of Gray Iron Institute

The annual meeting of the Gray Iron institute will be held in the Cleveland Hotel, Cleveland, on Wednesday, March 22, according to Arthur J. Tuscany, manager. The morning session will be devoted to reports of officers, reports on the various activities of the organization and the election of directors. A noted authority will address the members at the group luncheon. A conference type of meeting will be held in the afternoon with the members taking part in the discussion of activities.

Brick Specifications

Proposed Federal specifications for silica brick and silica cement, governing purchases of departments and independent establishments of the government, recently have been issued by the Federal Specifications board.

C. B. Templeton, formerly assistant to the president, Ludlum Steel Co., Watervliet, N. Y., has been made assistant to the vice president in charge of sales of that company.



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INTERNATIONALS

We claim for our 55 types of machines (3 new models recently added to our line) maximum SPEED, ACCURACY, DURABILITY, EFFICIENCY and VERSATILITY, and an entire absence of confusing complexity.

Write for a set of our Special Circulars showing a number of interesting foundry installations.

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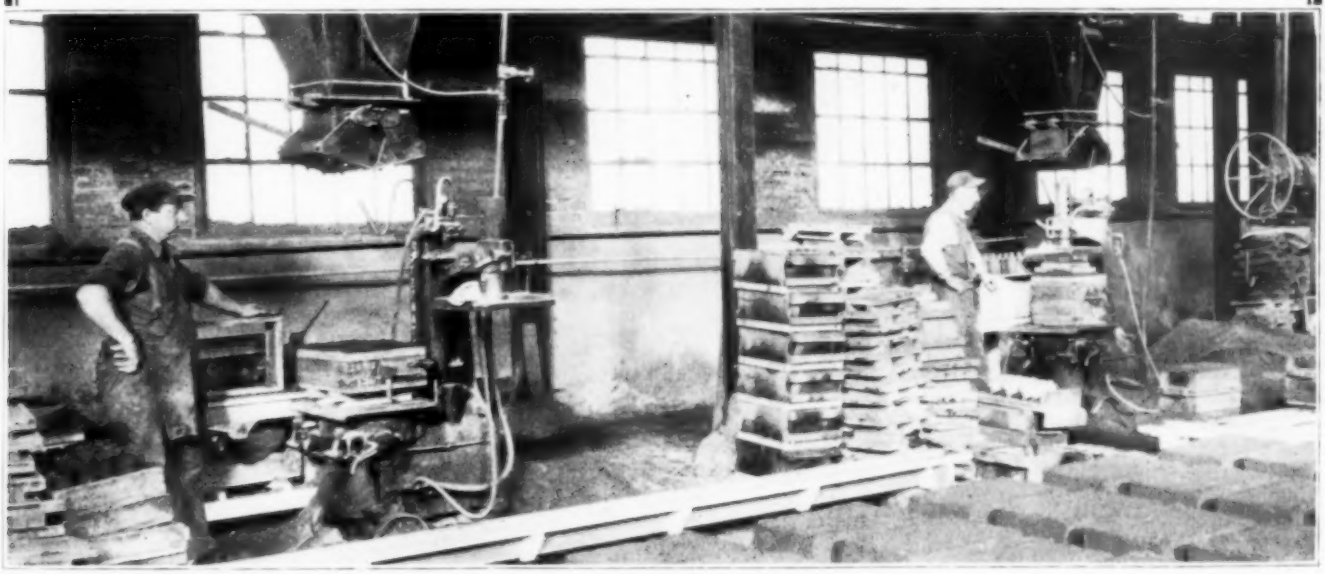


Reader's Comment

Interesting communications from readers of The Foundry

EDITOR'S NOTE—*Material Appearing Under this Head Does Not Necessarily Reflect the Opinion of* THE FOUNDRY *or of Its Editors.*

Doubts Possibility

TO THE EDITORS:

In comment on the discussion of Malleable Manufacturer in your last issue, I take issue with several of the points raised. Without casting any doubt upon the ability or knowledge of this individual, he is all wet on the idea that light weight castings always cost more than heavy ones. Many times, particularly in malleable work, core costs throw this generality out of line.

His reference to the war time classification has no application to present conditions, as I see it. Then prices were high and the agreement upon a classification took into account the desire to stabilize upon a comparatively profitable level to which all foundry men gladly agreed. I can't see where there would be any chance of establishing a classification in these days that would be proof against buyers' pressure or bushwacking of foundries hungry for business. Any classification attempted would necessarily be upon those castings that are made in large tonnages, that is repetition work, and how would it be possible to make plain to the buyer of small lots that he could not expect exactly the same low prices that now govern, for example, in automotive lines.

Quantities, weight, number per flask and cores, of course, are covered in the suggestions made, but it seems to me that such a classification would be better designated as a carryall than a yardstick.

You may print this, if you like, but I claim the same right as "Malleable Manufacturer" to remain unknown.

WESTERNER.

Prized Collection

TO THE EDITORS:

I wish to tell you that I have taken THE FOUNDRY through news dealers and subscription ever since it has been published—and expect to always be a subscriber. I had kept a scrap book of the many interesting shop articles during all these years. It was a very interesting collection which I prized highly. Lost it in the big Pueblo flood of 1921. Have another one well along.

I remember meeting your Mr. Penton at Put-In-Bay in 1892. The patternmakers were holding a national convention in Cleveland, June 1892. An excursion was given to Put-In-Bay and Mr. Penton addressed the gathering. I afterwards came to Detroit for a few days' visit and gave myself the great pleasure of a little chat with Mr. Penton. He surely in those days was the Big Push—in putting THE FOUNDRY over. I think he was everything but the actual printer. His success is well earned and may he live long to enjoy it.

Wishing THE FOUNDRY the very best for 1933 and all its years to come.

MARVIN B. KLATTENHOFF
Los Angeles, Calif.

One Left Out

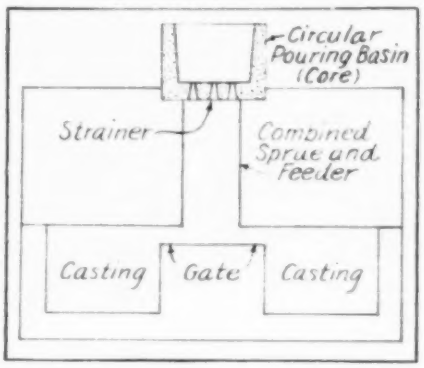
TO THE EDITORS:

A wide variety of methods for gating and feeding castings has been illustrated and described in THE FOUNDRY. Methods which without doubt have been of great assistance to many men faced with the responsibility of producing clean, sound castings. However, up to the present the writer has not seen a description of a combination gate and feeder for use on a casting.

In many instances several castings in a single mold are of such a char acter that either a feeder must be placed on each casting, or, one large feeder may be used and all the castings arranged to draw metal from this single feeder.

In our foundry we make a large number of castings which must be fed. These castings must be soft enough to machine readily and in addition must be free from dirt and shrink holes.

The combination strainer gate, pouring basin and feeder shown in the accompanying illustration, insures clear solid castings.



Showing application of a strainer pouring basin core over a combination sprue and feeder leading to the gates

R. E. WENDT
Foundry Instructor
Purdue University, Lafayette, Ind.

Nonshrinking

TO THE EDITORS:

In a paper "High Test Iron for Pressure Castings," by H. H. Judson, presented before the American Foundrymen's association at Detroit in May, 1932, and presented in the November issue of THE FOUNDRY, there is described a method of producing high test iron by melting steel in one cupola and soft iron in another cupola, then mixing these irons in the ladle in the required proportions. At the end of this article, Mr. Judson asks why this iron is nonshrinking. The following is believed to be the correct answer to this question.

When molten steel cools, we get a certain amount of shrinkage (or contraction) in the liquid state. When we reach the liquidus and the metal starts to solidify, this shrinkage continues, but probably at a different rate than when the material is completely liquid. Again, after the solidus has been reached, contraction continues in the solid metal. To prevent the formation of shrinkage cavities in the casting, risers must be provided of such size and so positioned that liquid metal will feed from these risers as long as there is any liquid metal in the casting itself.

High test cast iron when melted in the cupola, is made by melting a charge made up of nearly all steel, the purpose being to obtain a molten iron in which there is no undissolved graphite, which would act as nuclei and perhaps cause graphite separation while the iron was still in the liquid state. As a result of this complete graphite solution, practically no graphite separation occurs until the iron is solid and any tendency of the iron to expand due to the graphite separation is prevented by the solidity of the metal. It might be expected, therefore, that high test iron would require risers almost as large as would steel castings, if shrinkage were to be avoided.

If we can so control the separation of the graphite that it occurs an instant before, rather than sometime after solidification, the formation of the graphite which tends to increase the volume of the iron, will exert an expanding influence on the solidifying mass at just the instant this expansion is desired to overcome the actual cooling shrinkage.

Such control of the graphitization

(*Concluded on page* 40)

Definite Insurance against defective castings

A percentage of Charcoal Pig Iron in the mix helps you keep old customers and win new ones.

NOTHING is so good for a foundry as satisfied customers. And the fewer defective castings you sell your customers, the better satisfied they'll be. That's why so many foundries are using Superior Charcoal Pig Iron in the mix as a definite insurance against turning out defective castings.

By including at least 15% to 20% Superior Charcoal Pig Iron in the mix, the castings you produce will be stronger, tougher, longer-lasting. They'll be denser, more uniform, easier to machine and they'll turn out a better and higher quality finished product.

The insurance against defective castings which Superior Charcoal Pig Iron gives you is well worth the few cents extra cost. It will pay you dividends of fewer rejections, less scrap loss, and satisfied customers. And by turning out better castings, you take a long step toward winning new customers.

When you bid on castings, submit bids two ways—with and without Superior Charcoal Pig Iron. And tell your customers why.

SUPERIOR CHARCOAL IRON COMPANY
Grand Rapids, Mich.

Debevoise-Anderson Co. Inc., *Eastern Representative*
New York - Boston - Philadelphia

YOUR CASTINGS . . . *made with Charcoal Pig Iron have* . . . GREATER DENSITY · ADDED TOUGHNESS · MORE STRENGTH LESS SHRINKAGE · LESS SCRAP LOSS · GREATER UNIFORMITY · EASIER MACHINABILITY . . . *and you get higher quality finished products.*

Superior Charcoal Pig Iron

(*Concluded from page* 38)

will depend upon the concentration, size and distribution of the graphite in the iron, which, in turn, depend upon the method of adding the graphite.

For some time, the company with which the writer is connected has been controlling shrinkage of highly refined electric cast iron by the addition of soft pig iron to the furnace charge shortly before pouring. This corresponds almost exactly to Mr. Judson's method of adding molten soft iron to molten hard iron, the latter being the same as our highly refined electric iron.

It appears, therefore, that the non-shrinkage of Mr. Judson's iron is due to a sudden formation of graphite an instant before the iron solidifies. This is further indicated by the fact that his photomicrographs show complete primary graphitization, all graphite apparently having separated from liquid metal.

If the concentration and size of the graphite nucleii are properly controlled, there appears to be no reduction in the physical properties or increase in the porosity of the iron. There should, moreover, be an improvement in machinability as well as in the shrinkage.

C. L. Frear.
Metallurgist
De Laval Separator Co.,
Poughkeepsie, N. Y.

Wants More Data

To the Editors:

The reaction of one machine designer to the article "Iron for Pressure Castings" by J. H. Judson of the Goulds Pumps Inc. may be of interest to you. The article was in the November, 1932 issue of The Foundry.

Practical value was obtained from the data of the destruction tests of hydraulic cylinders which resulted in their bursting in the neighborhood of 3500 pounds per square inch hydraulic pressure. Reviewing the data: the cylinders were heavy castings weighing from 2000 to 3000 pounds each. Their wall thickness varied from 1½ to 2½ inches, the average thickness being 2¼ inches and with internal sections much heavier. They were cast from an ordinary semisteel heat, tensile tests performed on samples (cut from the walls of these cylinders) of which showed an ultimate strength of from 30,000 to 35,000 pounds per square inch.

Additional tests showed that: "The same type of cylinder cast with two-cupola iron would develop a bursting pressure of 6000 pounds per square inch."

More value would, it is believed, be gained by a machine designer if the foregoing information were supplemented by two additional facts, viz:

1. Diameter of ram, and

2. Thickness of cylinder wall

In connection with the need of the cylinder wall thickness, the statement that the "wall thickness varied from 1½ to 2½ inches, the average thickness being 2¼ inches" is considered rather indefinite. Is it to be understood that the cylindrical and plane bottom walls of the cylinder, which are the walls directly subjected to the hydraulic pressure, are 2¼ inches and unsupported by ribbing, etc.?

Even if we knew definitely the thickness of wall directly subjected to the hydraulic pressure, still we have insufficient data. We should know the ram diameter. Every formula we are acquainted with for figuring pressure cylinders is dependent on the ram size. This is because, given any certain metal, a wall of say 2¼ thickness will permit an altogether different pressure for say a 7-inch ram than for a different size ram, say 14 inches.

Taking the well known Lame formula, which we understand is generally used for cylinders of relatively thick walls subjected to high internal pressure, we see that the information given in the article under consideration is too indefinite to test the formula. We lack, as stated before, the ram size and cylinder wall thickness.

It would certainly be of great practical value to us to be able to examine the Lame formula on the basis of the findings in the destruction tests under consideration, which examination we could make if we had the additional data suggested by us. It would likewise be of value to weigh the other available methods of design calculation in the light of Mr. Judson's experiments. That everything may be definite, we point out that Lame's formula and certain other methods of figuring may be found on pages 366 and 367 of the January, 1919 *Machinery Handbook*.

Another point that is not fully clear is indicated by the following statements taken from the article. "The same type of cylinder cast with two-cupola iron would develop a bursting pressure of 6000 pounds per square inch. . . . The castings are tested at 35.0 pounds per square inch pressure and do not sweat. They operate under 900 pounds per square inch oil pressure and *even then* show no signs of sweating." (The italics are ours).

Are we to understand from the preceding paragraph that pressure cylinders that will develop a bursting oil pressure of 6000 pounds per square inch are subjected in practice to only 900 pounds per square inch? Conversely, are we to understand that a cylinder to be subjected in practice to 900 pounds per square inch must be capable of developing 6000 pounds per square inch oil pressure before destruction takes place?

Further, if the two-cupola semisteel cylinders were tested at 3500 pounds per square inch and did not sweat, why did the author expect them to sweat at 900 pounds per square inch, as we would infer from his words that we underlined that he expected them so to do?

Please accept this letter only in the spirit which is meant, viz: the seeking of further technical knowledge. Mr. Judson's article is considered a decidedly worth-while contribution to the practical design of hydraulic cylinders.

G. E. McLaughlin
Mechanical Engineer
Turner Tanning Machinery Co.,
Peabody, Mass.

Both Would Benefit

To the Editors:

I read the article in the January number of The Foundry proposing a classification of castings with great interest and sympathy.

I can see no reason why some such classification cannot be made, and I believe it is more important that *some* classification be generally adopted and used than that no action be taken because of criticism of the details of any particular one considered.

Naturally the better the classification, the better will be the results, and any classification generally adopted could be improved from time to time as experience indicates.

Such a classification with suitably proportioned values assigned to each item, would permit quoting by the use of discounts, whether done by distribution of the list to customers, and definite use of discounts and extras, or by use only to determine definite amounts to quote on each item.

The plan would in no way reduce or eliminate competition, but would make for more intelligent quotations with the spread reduced to reasonable proportions. Both producer and purchaser would benefit from such stabilization.

Robert E. Bryant.
Jefferson Union Corp.
Lockport, N. Y.

Discusses Welding

J. G. Ritter, welding engineer, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., addressed the January meeting of the Pittsburgh Foundrymen's association at the Ft. Pitt hotel, Pittsburgh.

J. H. Connors, vice president and general manager, B. F. Goodrich Co., mechanical goods division, has been re-elected chairman of the mechanical goods division of the Rubber Manufacturers association.

Prevent Losses with

Proper Gates and Risers

By PAT DWYER

OPINION may be divided on whether ancient foundrymen are entitled to a high degree of praise, or, modern foundrymen are open to a charge of lack of ingenuity, but the fact remains that the method of gating statuary and related forms of ornamental bronze castings has not changed since first practiced by the Greeks and Romans. Unfortunately, foundry statistics are not available on the methods practiced in casting the Golden Calf by the Israelites, but it is fairly safe to assume that it was molded and cast in the same manner.

In this connection also it is interesting to note that the so called Roman joint, developed by these ancient artificers, still is used where various parts of a statue are cast separately and afterward united to present an unbroken surface. Details of that form of joint are shown in Fig. 194. The adjoining ridges are hammered down flat so that the metal flows into intimate contact and then are filed or scraped until no joint is visible.

The distance molten metal will flow depends on its fluidity and the volume of the stream. Manifestly a large thick stream will remain in the liquid state and flow farther than a small thin stream exposed to the temperature robbing effect of the walls of the mold. The walls of a statue or other piece of ornamental bronze are extremely thin and as a result the metal from a gate, irrespective of its fluidity, will not flow far from its source.

To meet these conditions the metal is introduced to the mold through a multiplicity of gates, each one designed to fill a definite area of the mold. Also, and this is one of the most important points, the metal in each of these areas must be in a fluid condition when it meets the metal from the other areas so that the metal in the various areas will unite to form an unbroken entity.

No definite rule can be laid down on this subject since these castings are largely of an individual character and in the great majority of instances are not duplicated. Almost without exception the detail of gates for any given casting is peculiar to itself.

Use Wax Gates

STATUARY and other ornamental bronze castings are largely of an individual character and present many features which necessitate the use of gates that differ to a considerable extent from those employed in other branches of the foundry industry. Wax sections of varying diameters are rammed up in the mold. When the mold is dried these wax sections melt and thus leave passages for the distribution of the metal to all parts of the mold. All passages lead to a common sprue under an opening in a basin or reservoir in which all the metal is poured. A multiplicity of small wedge gates connected to generous size runners is recommended for use on medium size and large tablet castings.

However, the general principle is the same in all cases. A large reservoir or basin is erected on top of the mold and a large sprue from the bottom conducts the metal to the required number of gates leading to various parts of the mold cavity. In effect the main sprue with its numerous ramifications may be compared to the stump of a tree and its numerous roots. The tip of each root constitutes an entrance for the metal to the mold. On large jobs these roots vary from a few inches to several feet in length and from a fraction to over an inch in diameter. The finished casting released from the sand is enclosed in a network of metallic grape vines.

Several interesting features connected with pouring the metal into the mold for a large ornamental bronze casting are shown in Fig. 195. Particular attention is directed to the binders and turnbuckles employed to hold the various parts of the mold together as a rigid unit.

On account of the large area of the casting, high head and the speed with which the metal enters the mold, a terrific strain is imposed on the walls of the mold. Since these castings must conform absolutely to every detail of the model or pattern, no strain or swell of any kind can be tolerated.

The molds are made in French sand imported into this country from a deposit—so far as known the only one of its kind—in the vicinity of Paris. This sand possesses the contradictory qualities of extreme fineness and high permeability. It will take the finest impression, will bake as hard as a brick and yet the metal will lie as close to it as it will to a coarse grain, open sand.

In some instances the casing for the reservoir is cast iron, while in others as in the instance illustrated it is made up of two sections of steel plate, bent to an oval shape, hinged at one end of the long diameter and held by suitable catches at the other end. The casing is lined with molding sand, black washed and dried before it is placed on top of the mold.

On account of the practical difficulty of estimating accurately the exact amount of metal required to pour a casting of this kind, also as a precautionary measure, it is customary to melt more than is considered necessary to fill the casting and the various gates. The sprue opening in the bottom of the basin is plugged and the entire amount of metal is poured into the basin before any is allowed to flow into the mold.

Lift the Plugs

In the mold selected for illustration, Fig. 195, the reservoir supplies metal to two sprues in the bottom, hence the two cast iron plugs suspended by small steel cables from a temporary trapeze. The plugs were coated with graphite and dried before they were adjusted in position with the lower ends resting in the tops of the sprue openings. When the basin was filled with metal, attendants on the floor, pulled on the cables, thus hoisting the plugs and allowing the metal to flow into the sprues.

Under certain conditions a basin is

employed which is not large enough to hold all the metal required to fill the mold. In a case of that kind the basin is filled before the plug or plugs are removed. Then a stream from the ladle keeps up the level of metal in the basin until the mold is filled.

A hole in the side of the basin near the bottom is kept plugged until the mold is filled. The hole then is opened and the surplus metal in the basin is drained into a waiting ladle or into a pig bed. The usual practice is to pour this partially cooled metal back into the furnace where it forms part of the next charge. Crucibles are employed in some foundries engaged in this class of work, but the modern tendency is toward furnaces where a comparatively large amount of metal may be melted as a unit, and then tapped directly into a large ladle. Where crucibles are employed they are drawn one at a time and emptied into a ladle. The net result is the same in both cases.

On some comparatively plain castings, wood gate pins, round, oval or rectangular, or sections of small steel pipe are employed, but in the majority of instances the gates follow a tortuous course and for that reason cylindrical sections of wax present the only alternative. These sections, cut and bent as required, are placed in position and left in the sand. The heat required to dry the mold, melts the wax and leaves an open passage for the metal later.

Poured on Edge

Several methods are employed in gating tablets and other castings of the same general character. The method adopted in any given instance depends to some extent on the size and shape of the casting and to some extent on the available rigging. For example, it would be idle to attempt casting a large tablet on edge if a rigid iron flask and facilities for drying the mold were not available. Many tablets are cast successfully in green sand in wood flask in a horizontal position.

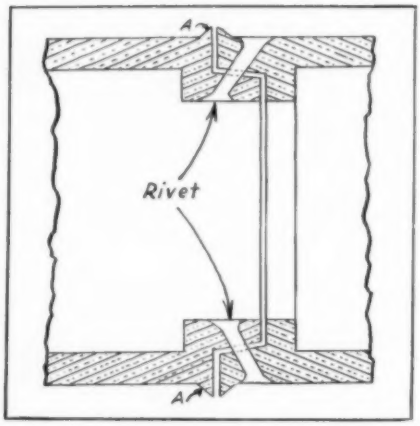


Fig. 194—In a roman joint the ridges A are hammered down flat and then finished smooth with a file and scraper

Where the thickness of metal is sufficient and the distance to the center is not too great, a tablet may be gated at one or both sides and at one or both ends. This may involve the use of four crucibles and imposes no great hardship where a sufficient number of men are present.

However, it means extra work and is avoided wherever possible by arranging a set of gates that may be fed from a single pouring basin.

The minimum amount of metal is required where the mold is made in the usual manner and then turned up on edge to receive the metal. A row of thin gates at the joint conduct the metal from a long, narrow pouring basin into the mold cavity. Gravity assists the metal to fill every part of the mold. Manifestly only a hard, dry mold and a rigid iron or steel flask will withstand the pressure of the metal introduced in this manner. A prominent art foundry in Chicago has practiced that method for many years.

A modification of the idea was used by a Canadian foundry in pouring a large bronze door with five panels. The mold was tilted about 2 inches to the foot. Even with a rigid flask some trouble was experienced by the mold cracking during handling. The trouble was minimized to a great extent by making separations in the mold following the lines of the panels.

Used Five Reservoirs

The mold was poured from five reservoirs in which the metal was released simultaneously. The plugs in the reservoirs were 2 inches in diameter with sprues leading to the runners and gates leading from the sprues directly into the center of each panel. The five reservoirs were spaced about 18 inches apart with gates extending down to the plate and with additional sprues extending down to feed gates in each of the five panels. The sprues were 1¼ x 2 inches and the gates leading into the mold were ¼ x 2 inches. Sufficient metal was provided to prevent any dross from entering the sprues at the end of the pouring.

To prevent the mold from straining, the cope was covered with perforated steel plates held down by three steel rails anchored at the ends. Five I-beams rested on the rails at right angles, with the ends attached by bolts to similar beams on the bottom of the mold.

The door had to match a framework of extruded metal and apparently called for a formula of copper 80 per cent, zinc 16.5 per cent and tin 3 per cent with possibly 0.5 per cent lead. Anticipating trouble from the large amount of zinc, this metal was cut to 10 per cent and the others adjusted in proportion. The color was quite satisfactory. The metal was melted partly in an electric furnace and partly in crucibles. It was taken from the furnaces at a temperature of 2350 degrees Fahr. and poured at a temperature of 2150 degrees Fahr.

One of the best, if not actually the best method for gating a tablet casting was described on page 585 of THE FOUNDRY July 15,1927. The casting is molded horizontally face down in the usual manner and gated on the back through three or more rows of wedge gates. The number depends on the total area of the casting. Small wedges 1½ x 1½ inches, ¼-inch thick at the top, tapered to 1/16-inch at the bottom, are placed in straight rows on the pattern 8 or 10 inches apart and a thickness of sand is rammed around them to hold them in place. A length of 1-inch pipe is laid horizontally on top of each row of wedges and partly covered with rammed sand. The pipes then are lifted out temporarily to permit re-

(*Concluded on page* 44)

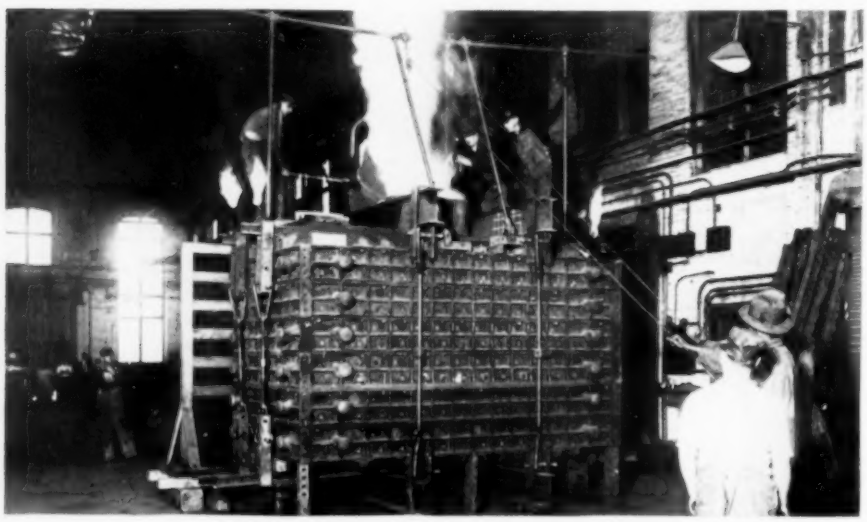


Fig. 195—At a given signal the plugs are lifted and the metal in the basin rushes down into the sprues and thence to a multiplicity of gates

While You MARK TIME

LATELY you've probably thought of many things that you need to do to get going right. But the chances are that what you have in mind runs into bigger money than you can afford to spend while volume and price levels are low.

You are probably right in marking time on big expenditures. But what about small investments on portions of your production, where a few hundred dollars for simple equipment will put itself back into your pocket in a few months?

A simple overhead hopper like this pays for itself in short order.

Take the case of a midwest steel foundry. Fifteen hundred dollars into an equipment for filling flasks from an overhead hopper wiped itself out in savings in three months. Again, an eastern valve manufacturer puts less than a thousand dollars into an overhead sand hopper and a roller conveyor for molds. Three to four short months clean up the investment. After that this little rig is good for a saving of $250.00 per month—$3,000.00 per year—more than 300 per cent annually on the investment.

Let the big things ride, if you must. But go hard after the smaller things that will pay for themselves in short order by bringing costs down and quality up, by making it possible to get a bigger slice of the available volume. Let us help you by having a Bartlett-Snow representative who knows what can be done with simple handling equipment at your plant, whenever you like, to make a check-up with you.

If you prefer, write us and we'll send you some interesting photographs of simple low-cost equipment that may point the way to the problem of bringing down your costs and building up your volume.

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BARTLETT-SNOW

SAND HANDLING AND MOLD CARRYING EQUIPMENT

(*Concluded from Page* 42)

moval of the wedges. The pipes then are returned to place and an upright runner placed on each and if necessary, slanted to a common center so that the entire set of runners may be served from one basin in which the sprue is plugged until the basin is filled with metal. After the cope is rammed the pipes are pulled through holes in the end of the flask and the holes plugged with short pieces of stock core.

A suitable sand is made by mixing equal parts French sand and No. 00 Albany sand which must be tempered properly, rammed hard and dried. A skin drying is sufficient for small and medium size castings.

After the mold is closed, binders are clamped across the top of the cope and wedges are driven between the binders and the tops of the bars to prevent the mold from straining. Wedges also should be driven between the lower edge of the drag and the bottom plate or board. If this precaution is not observed subsequent clamping of the flask may pull the board or plate up and shut off the mold thickness in some places.

Before leaving this particular branch of the casting industry, a branch perhaps the least familiar of any to the majority of foundrymen, it will be of interest to present a description of the unique methods pursued in at least one East India foundry. The description is taken from an article by C. L. Shunk in THE FOUNDRY, Sept. 1, 1928.

"Several years ago the writer spent some time in India and was privileged to observe many of the industrial methods employed there. Generally speaking the East India worker is not a progressive fellow if left to his own devices. His most outstanding tendency is to run in the groove cut deep by many generations of his forebears.

"He is taught that he is dishonoring his fathers if he leaves the time honored methods, devices and trade secrets, handed down through the centuries, in exchange for others be they ever so good and well tried.

Mold and Pot in One

"On one occasion a chance visit to a comparatively large machine shop and foundry under European supervision showed a combination of Occidental efficiency with Oriental thoroughness. One product required a high grade brass casting with an irregular smooth surface and sharp, accurate corners difficult to machine.

"The English manager of the establishment said he had tried to get results with English methods but had failed. He then used successfully an adaptation of the native brass workers' method.

"They use a kind of clay mixed and kneaded until it *feels* just right to the molder. The pattern, which always included the gate and riser connecting a form for the metal melting chamber as shown in Fig. 196, was split on the parting line and the two halves were laid on an even surface covered with a thin piece of oiled paper.

"The workman then pressed a sufficient layer of the clay around the

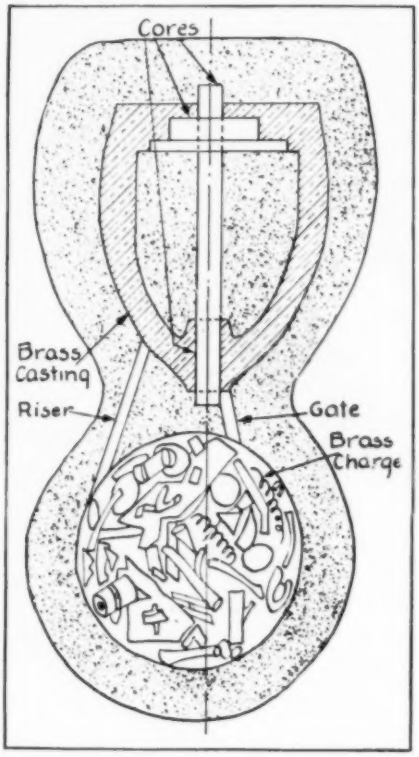


Fig. 196—Position of the mold while melting. The mold is reversed to pour

pattern halves down to the paper on the molding board. The paper made it easy to turn the pattern halves and mold to remove the pattern. The two halves of the mold were air dried for a day or two, sun dried and then furnace tempered. Cores of the same material were made by the same process.

"When the two halves of the mold were pasted together, a predetermined weight of brass scrap was enclosed in the metal chamber. The mold and its crucible locked in a pair of tongs was hung crucible down in the furnace until the metal was ready to pour. The entire mold then was turned over and the molten brass charge flowed into the mold cavity. The mold then was allowed to cool and afterward was broken away from the casting.

"There was practically no loss through oxidation, since the air was excluded during the entire melting process. The brass scrap had a low melting temperature."

This is the thirty-eighth of a series of articles dealing with the various types of gates and risers used in the foundry industry. The thirty-ninth installment will appear in an early issue.—THE EDITORS.

Book Review

The Alloys of Iron and Molybdenum, by J. L. Gregg, cloth, 507 pages, 6 x 9 inches, published for the Engineering foundation by the McGraw-Hill Book Co. Inc. and supplied by THE FOUNDRY, Cleveland, for $6.00 plus 15 cents postage and in Europe by the Penton Publishing Co. Ltd., Caxton House, Westminster, London.

This is the first of the Alloy of Iron Research, monograph series and represents a concise but comprehensive critical summary of research on ferrous alloys as reported in the technical literature of the world. This monograph was prepared at the Battelle Memorial institute as a part of that organization's contribution to the Alloys of Iron Research. The work has been prepared for a double purpose, namely, to present all available information on the subject of molybdenum as an alloy in iron and steel, and at the same time to point out the gaps in available information, so that the need for research to fill those gaps will be more evident.

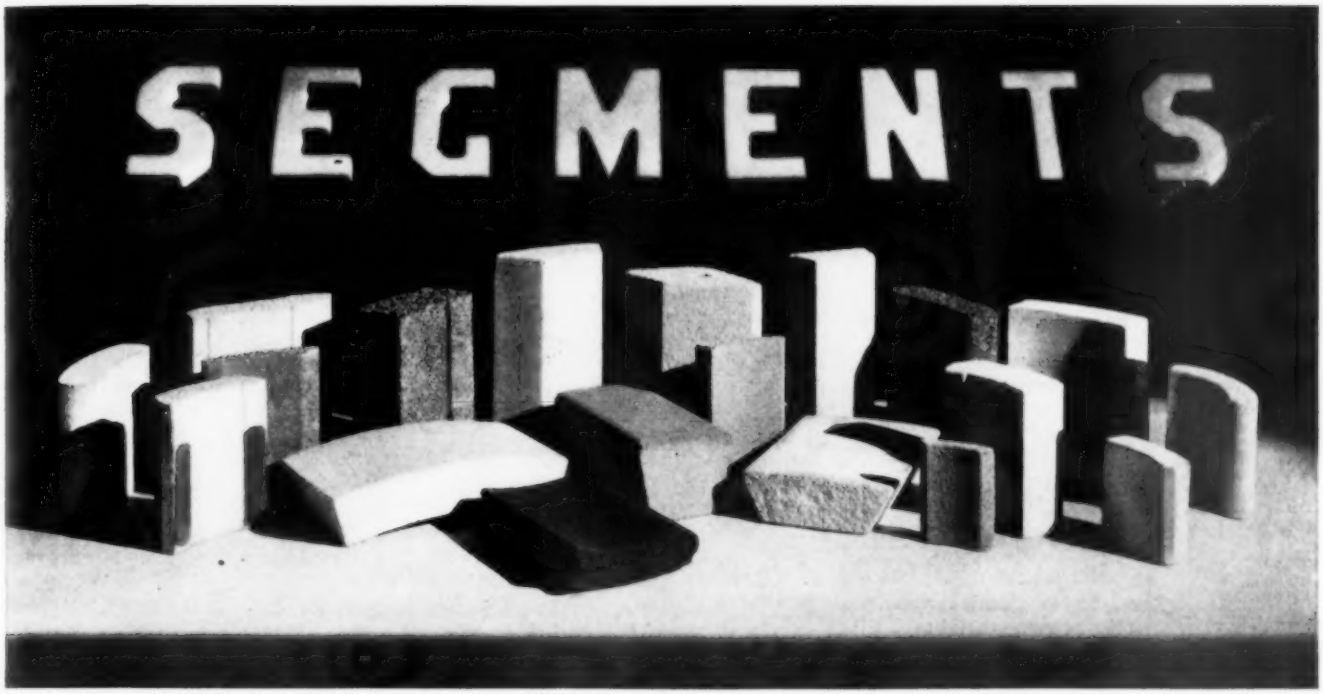
Following a general introduction and survey of the work, the author gives information on the properties of molybdenum, the occurrence of the metal and methods of extraction. He then takes up the iron-molybdenum alloys, the constitution, methods used in determining the iron-molybdenum diagram, properties and uses. Under a discussion of constitution and manufacture, the subjects of iron-carbon and molybdenum-carbon alloys, iron-molybdenum-carbon alloys, melting molybdenum steel, and casting and working molybdenum steel are included.

After a discussion of metallography and physical properties of molybdenum steel and the properties and uses of that alloy, the author takes up the subject of molybdenum in cast iron, and discusses manufacture, influence of molybdenum on structure, mechanical properties, special properties, effect of temperature and uses. Other subjects included in the work are as follows: Chromium-molybdenum steel, nickel-molybdenum and nickel-chromium-molybdenum steels, molybdenum in high speed steels, molybdenum in nitriding steels, and other iron-molybdenum alloys.

Following each chapter, the author presents a brief summary of the facts listed in the chapter.

Handles Exhibits

Frank H. Gale, manager of conventions and exhibits, General Electric Co., Schenectady, has retired after 43 years of service and L. W. Shugg has been appointed division manager of the publicity department to succeed Mr. Gale in charge of that work.



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Good Housekeeping at Falks

(*Concluded from Page* 12)

so connected that both molasses and water can be fed through it into the funnel and down to the batch. Sand and other dry materials are fed through the three ports shown. The small port at the left is for fire clay while one of the others supplies new sand and the third one reclaimed sand. Ports all are fitted with measuring devices which will permit only a predetermined amount of material to enter the mill at one time. These measuring devices, as well as the enclosures themselves, are the result of our own design and construction.

Referring back to Fig. 1, the dry materials are fed to the mixers through the large pipes from overhead bins. An overhead tank supplies molasses through the vertical pipe shown between the two mills while the lower connection of the same pipe leads to water lines.

Other dust control activities are illustrated in Fig. 5. The man at the left is using a lawn spray in wetting down the floor while the other is using a home-made device for spraying a finely divided cloud of water into the air to bring down dust. We find that this water atomizer will clear the air of a large percentage of dust particles in a comparatively short time. Also, it may be used for wetting down castings which have just come out of the sandblast and are dusty, without at the same time pouring too much water over them. The construction of the atomizer is shown in the closeup in Fig. 3. It was made of an old acetylene tip so connected that water is supplied through the small holes in the periphery of the nozzle while air is blown through the central opening. The amounts of water and air can be regulated readily by the valves shown. Two such atomizers now are in use in our chipping room and are proving effective.

Build Booth for Grinder

A further attempt at the alleviation of the dust situation is illustrated in Fig. 4 The booth shown houses a swing grinder and canvas curtains may be drawn across the front of it to close it off from the rest of the shop. An exhaust duct reaches across the rear of the booth and dust is collected through it by the fan at the right and is blown into a collector on the outside of the building. Respirators and a fresh air helmet are provided for the men who work in the booth. The booth shown was constructed merely for experiment and has proved to be successful. It is possible that others of a similar type will be built to house other grinders located in the shop.

As was mentioned previously, a number of improvements have grown out of this crusade against dust which are not related to dust control. Tool cribs similar to those shown in Figs. 6 and 8 have been erected in various parts of the shop. Racks and fittings of each crib have, of course, been adapted especially to the variety of tools used in the particular department in which the crib is located. The crib shown in the illustration is situated between the large molding department and the large core department and easily is accessible to both. Tools are issued on tool checks and must be cleaned up and put in shape before being returned.

Keep Tools in Crib

The crib is a woven wire enclosure and houses only tools. Supplies such as nails, chaplets, etc., are issued from a supply room which is in another part of the shop. Prior to the erection of the tool cribs, each molder kept all his tools, both large and small, in his locker. The result was that each man had a length of hose, an extension cord, a shovel, a pneumatic rammer, an assortment of floor and hand rammers, a hammer, two or three riddles, sprinkling cans and spray cans, core hooks and a host of other articles which he hoarded and guarded jealously from all other men in the shop. That meant that perhaps far less than 50 per cent of the available equipment was in use at any one time, and, naturally, abuses grew out of this arrangement. Now, each molder can get the necessary tools from the crib, the small tools being placed in one of the boxes shown in the foreground in Fig. 8. He must return them all in good shape at the end of the day.

Obviously, this new idea has many possibilities in eliminating a number of expensive leaks and wasteful practices. The attendant in the tool crib will spend his time between calls at the wicket in making runner cups.

The supply room referred to is shown in part in Fig. 7. Old wooden shelving has been replaced by modern steel bins and the pleasing effect has been furthered by the application of white paint and aluminum paint to walls and ceiling. Nails in keg lots, grease, oil, etc., are kept in a space to the left and a machine for arranging nails with the heads all in the same direction is shown in the right foreground. Nails can be taken from the machine in handfuls and bundled, held by rubber bands for distribution to the molding floors and the core rooms. Also, there is a machine for cutting off wires to predetermined lengths in quantities. The attendant in the supply room keeps a card inventory of the supplies on hand.

This is the first of two articles describing housekeeping methods of the Falk Corp. of Milwaukee. The second will appear in an early issue.—THE EDITORS.

A. I. M. E. To Meet In New York Feb. 20-23

The 142nd meeting of the American Institute of Mining and Metallurgical Engineers will be held in the Engineering Societies building, 29 West 39th street, New York, Feb. 20-23. Numerous papers of interest to foundrymen will be presented in various sections of the meeting, including the following: "An Improved Nickel-Chromium Hardened Chilled Cast Iron" by J. S. Vanick; "A New Thermocouple for the Determination of High Temperatures, Including Liquid Steel Temperatures" by G. R. Fitterer; "Properties of Low-Carbon Medium-Chromium Steels of the Air-Hardening Type" by E. C. Wright and P. F. Mumma; "Effect of Variations in Coke Ash on Pig Iron Analysis" by H. W. Johnson; "A General Analysis of the Gas-Metal Problem and Its Practical Importance" by Dr. John Johnston; "An Evaluation of Analytical Methods for Determining Gases in Metals" by P. H. Brace; "Gas-Metal Problems of the Brass Industry" by J. L. Christie; "The Gas-Metal Problems of the Nonferrous Foundryman" by E. R. Darby; "The Interpretation of Gas-Metal Reactions in the Light of Phase Equilibria" by Dr. C. H. Mathewson; "The Gas-Metal Problems of the Steel Industry."

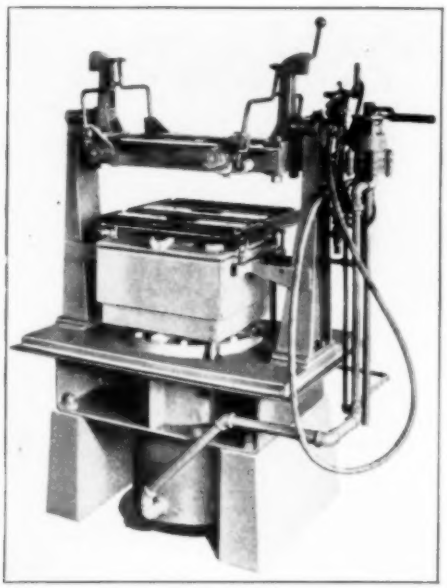
Is Made President

F. J. King (see Family Album, page 34), chief engineer, Linde Air Products Co., New York, recently was elected president of the Compressed Gas Manufacturers association. Mr. King has been affiliated with the Linde company since graduating from the Massachusetts Institute of Technology, Cambridge, Mass., in 1919.

Forms Company

Professor Pisek, Ecole Polytechnique de Brno, Brno, Czecho Slovakia, has become associated in Inventio, Ltd., Prague II, Panska 9 a company organized to act as an intermediary in negotiations relating to inventions, patents and methods of manufacture abroad and to give professional advice concerning the utilization of foreign patents seeking outlet in Czecho Slovakia.

TABOR MOLDING MACHINES



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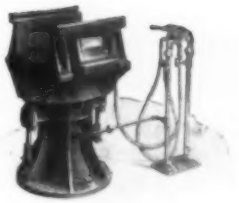
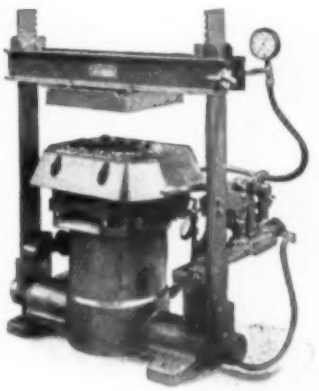
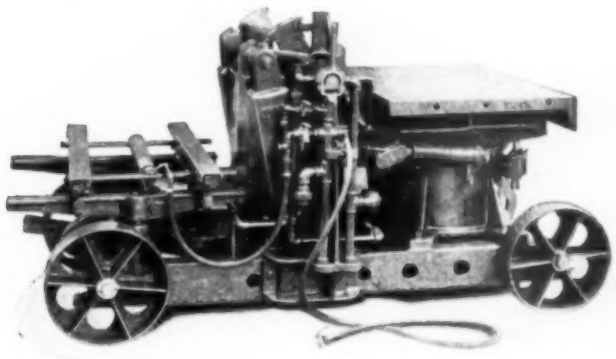


Jarring Flask Lift Machine
(Plain or Shockless Jar)



Power Squeezing
Split Pattern Machine

Shockless Jarring-Squeezing
Flask Lift Machine



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The Foundry Through the Years

(*Continued from Page* 19)

time many refinements have been made on that type of machine, and today many are in use in molding a wide variety of work. Along the lines of new equipment, THE FOUNDRY pointed out editorially in April that "high labor cost is the compelling factor that is driving foundrymen into the equipment market at a time when least expected."

Indeed, 1919 was an interesting year. Everything was bigger and better including the annual convention and exhibition of the American Foundrymen's association which was held in Philadelphia.

At the outset, 1920 bade fair to beat all records. In January, THE FOUNDRY stated that "the foundry industry enters upon 1920 as a year of unprecedented activity." By March, "the demand for castings, which steadily increased during the past two months, now has become acute." In April, the castings industry was overwhelmed with business. This situation continued for a brief period and then a breakdown of transportation facilities resulted in a shortage of coke and iron. By October, the picture had changed entirely, business had dropped off and with few exceptions, a buyers market for castings governed. In December THE FOUNDRY reported that the foundry industry was severely affected by the depression which had swept the country.

Stress Plant Developments

Remarkable progress which had been made recently in foundry construction and layout offered much of interest to the industry, and many articles were presented pointing to major developments. For example, a series of three articles described in detail the practice followed at the Saginaw Malleable Iron Co., Saginaw, Mich., and stressed especially a kiln of the tunnel type for the continuous annealing of castings. Numerous subjects were discussed in serial articles during the year. H. E. Diller covered a wide field in an interesting series "Manufacturing Chilled Iron Car Wheels." H. W. Gillett wrote approximately a dozen articles on "Electric Melting of Alloys." A series of articles presented a standard foundry cost system developed by C. E. Knoeppel & Co., New York.

Interesting information on numerous widely known individuals in the foundry industry appeared in THE FOUNDRY during the year. Fred Erb, then foundry superintendent, Parkard Motor Car Co., Detroit, was elected president of the Detroit Foundrymen's association. This was the first step in association leadership that later was to include the presidency of the A. F. A. James A. Murphy was made foundry manager of the Connersville Foundry Co., Connersville, Ind. Matthew Riddel was elected president of the Institution of British Foundrymen and Oliver Stubbs was made senior vice president. Albert E. White, a professor at the University of Michigan, was elected president of the American Society for Testing Materials. W. R. Bean, Eastern Malleable Iron Co., was made president of the American Foundrymen's association at the annual convention and exhibition held in Columbus, O. Major R. A. Bull, resigned as vice president of the Duquesne Steel Casting Co., to become consulting metallurgist for a group of six steel foundries, which later became known as the Electric Steel Founders Research group. Edwin S. Carman of the Osborn Mfg. Co., was elected president of the American Society of Mechanical Engineers.

In 1921, the depression was the big news, not only in the foundry industry but among business men in general. Each month temporarily was regarded as the low point in the curve until the next month's business moved just a little lower. Nevertheless, in a manner which always has been more or less characteristic of the industry, optimism prevailed. Foundrymen believed that business soon would return to a normal basis, and continued preparations for that time.

New names, faces and events appeared in THE FOUNDRY during the year. Lieut. F. R. Nourse, U. S. Navy, wrote on "Foundry Maintained on Repair Ship," which described the U. S. S. PROMETHEUS of the Atlantic fleet. C. H. Gale, known today as the industry's greatest traveler, contributed an article on "Anneal Steel with Pulverized Coal." George H. Manlove, then Chicago representative of THE FOUNDRY, was the author of an article describing refinements in the sand slinging machine.

Pat Dwyer has written many articles on the manufacture of cast iron pipe and pipe fittings, including an exceptionally complete series which appeared in 1930 and 1931. His first article on that important part of the foundry industry was presented in the Jan. 15, 1921 issue under the heading "How Soil Pipe Castings Are Made," and described the Somerville Iron Works, Somerville, N. J.

Methods of refining iron received the attention of Dr. Richard Moldenke in an article "Electric Furnace Improves Gray Iron." Wesley J. Lambert, later president of the Institute of British Foundrymen, contributed an article on "Propellers Cast in British Shop." Cost information was given prominence in an article by Robert E. Belt, secretary of the American Malleable Castings association in an article "Advises Use of Uniform Cost System."

An early contribution of R. F. Harrington, Hunt-Spiller Mfg. Co., Boston, was entitled "Tests Show the Quality of Core Oils." Another world traveler in the person of F. J. McGrail, then superintendent of the Honolulu Iron Works Co., joined the ranks of the contributors with an article "Hawaiian Plant Makes Heavy Work." Recent progress in a new field was outlined by E. F. Northrup in "High Frequency Inductive Heating," and George A. Drysdale, later metallurgical editor of THE FOUNDRY, wrote on "Seeks Better Acid Resisting Alloys." John W. Bolton, then chemical engineer, Niles Tool Works Co., Hamilton, O., contributed his first article to THE FOUNDRY under the title "How Slag Affects Cupola Operations."

New Equipment Shown

Early in 1922, THE FOUNDRY, in speaking of equipment development, stated editorially that "progress always has attended more faithfully upon eras of industrial stress, and the period now closing should be no exception." The prophecy was correct, for the annual exhibition of equipment at the A. F. A. convention in Rochester, N. Y., was marked by the new equipment and supplies displayed for the first time.

Throughout the year, THE FOUNDRY described many developments including the following: A machine introduced by the Osborn Mfg. Co., Cleveland for delivering molding sand into the flask, a hand controlled hoist of the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., for handling small and medium loads; a device to permit a man to pour and skim a crucible of metal at the same time, which was introduced by the Modern Pouring Device Co., Port Washington, Wis.; a molding machine designed by the Wm. H. Nicholls Co., Brooklyn, N. Y. to meet peculiar conditions in foundries running on long production jobs, but not equipped with sand or mold conveyors; a sand separator and blender of the Royer Foundry & Machine Co., Wilkes-Barre, Pa., which "can produce a barrow full of clean sand from a dirty sand pile in two minutes"; a small blower of the positive pressure type introduced by the Connersville Blower Co., Connersville, Ind.; a tilting type sandblast barrel designed by the W. W. Sly Mfg. Co.,

(*Concluded on Page* 50)

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(*Concluded from page* 48)

Cleveland; and a sandblast barrel having adjustable nozzles introduced by the Pangborn Corp., Hagerstown, Md.

Other news taken from here and there during the year is of interest: Egbert H. Ballard, manager Everett works, General Electric Co., later president of the A. F. A. was elected president of the New England Foundrymen's association; a considerable tonnage of castings was anticipated from a proposed tunnel under the Hudson; Eugene W. Smith pointed out in an article on "Sand Offers Field for Improvement" that many factors enter into the preparation of sand for molds; Vincent Delport, now European manager of THE FOUNDRY was appointed French representative of this publication; and J. D. Hoffman and R. E. Wendt of Purdue university contributed an article on "What Technical Schools Have To Offer."

In February of 1922, THE FOUNDRY stated that "improvement in castings production is so slow as to be almost imperceptible." It was thought in March that the long pull back to prosperity had started, and business continued to improve during the summer. A cloud appeared on the industrial horizon in the summer, due to the railroad strike, and irregularity in trade tendencies was encountered in some branches of industry.

In bidding farewell to the passing year, THE FOUNDRY provided the following glimpse into the future: "Restrained optimism correctly describes the attitude of the foundry industry at the close of 1922. Practically all lines of castings manufacture are on a sound basis with orders on their books, with an ample volume of inquiry to support the expectations for prosperity in the first of the year and with inventories reduced to a reasonable status. The flurried activity of the post-war period, and the deep pessimism, the feeling of helpless futility, which marked the low point of past business depressions alike, are absent. Construction of new plants and additions to existing establishments testify to the industry's faith in the future."

Thus did THE FOUNDRY introduce the period of greatest prosperity in the history of America!

F. G. S.

Gray Iron Institute Considers Classification Plan for Castings

MORE than fifty gray iron foundrymen from four States attended a clinical discussion of conditions in the industry under direction of the Gray Iron institute at the Congress hotel in Chicago, Jan. 26. A. E. Hageboeck, Frank Foundries Corp., Moline, Ill., president of the organization commended the organization for operating within its reduced budget during the fiscal year, ending Oct. 1, 1932. The most important accomplishment of the period, he said was the adoption through the American Society for Testing Materials of a new code of specifications for gray iron establishing tentative classifications based upon physical properties.

Points to Dangers

Dean Ralph Heilman, school of commerce, Northwestern university, Evanston, Ill., as guest speaker pointed to the dangers of ill advised legislation having to do with business. He approved the necessity of regulating public utilities, but deprecated the spreading tendency to permit government to encroach on private business. He stated that all social progress and individual welfare demands as little governmental restriction as is possible, consistent with the protection of public life, safety and welfare and urged the support of all safeguards in maintaining individual competition. More than a million and a half laws, national, state and local now circumscribe the activities of the American people.

The promotion of acceptance of gray iron castings as reliable engineering materials has been the basis of the work of the institute technical committee, according to Manager A. J. Tuscany, Cleveland. The present tentative specifications will furnish a basis for a certification plan, now being considered by the directors of the institute. The problem of a classification of general uses, and the recommendation of a series of grades for specific purposes was discussed.

Light gray iron castings require more intensive study and this work has been undertaken, according to a report of E. B. Sherwin, Chicago Hardware Foundry Co., North Chicago, Ill. The ability to specify cutting rate in machining is particularly important in light, thin section gray iron castings. The drill test, while suitable for comparison purposes is not regarded as sufficient. Like the transverse test, long used by gray iron foundrymen, it may be applied as a control test. It is proposed to conduct research on tensile, rigidity, machining and damping properties of light gray iron.

C. A. Ziebell, Universal Foundry Co., Oshkosh, Wis., urged wear and machining tests as extremely valuable. He appraised the work of the institute in raising standards as directly beneficial to stockholders and the public, as well as to the actual foundry operators. Benefits of the institute technical advisory service was reviewed by A. C. Peebles, Stedman Foundry & Machine Works, Aurora, Ind.

A plan of reciprocal insurance adopted by members of the institute was outlined by Fred Erb, Eaton-Erb Foundry Co., Vassar, Mich., who reported savings in the first year, on premiums of 50½ per cent through this arrangement.

A. E. Grover, cost consultant of the institute, Cleveland, read a paper by J. J. Rowbottom, Diversey Foundry Co., Geneva, Ill., in which the need for adherence to a basic, uniform cost method was stressed. The cost per day of indirect labor and the distribution of burden are vital. The habit of quoting by 100 pound weight unit gives undue importance to low cost jobs in depressing the market price. Costs per piece or per unit and the desirability of quoting prices upon a similar basis were urged. The buyer has no appreciation of the influence of the labor factor upon price with any bulk commodity, price per pound basis of quotation.

Cites Relation of Design to Good Castings

Major R. A. Bull, director, Electric Steel Founders' Research group, Chicago, was the speaker at the January meeting of the Quad City Foundrymen's association held Monday, Jan. 16, at the Hotel Blackhawk. Mr. Bull talked on "New Aspects of Competition and Applications of Alloy Steel Castings and the Relation of Good Design to Good Castings." His talk was illustrated by lantern slides. Charles F. Scherer, Davenport Machine & Foundry Co., Davenport, and president of the association, presided. John Ploehn, French & Hecht Corp., Davenport, introduced the speaker.

Numerous visitors were present including a group from the State University of Iowa and also a deligation from Cedar Rapids, Ia. The February meeting will be held at the LeClaire Hotel, Moline, Ill., Feb. 20.

Chromite in 1931, by L. A. Smith, recently has been published by the U. S. department of commerce, bureau of mines. The pamphlet may be secured from the Superintendent of Documents, Washington, for five cents.

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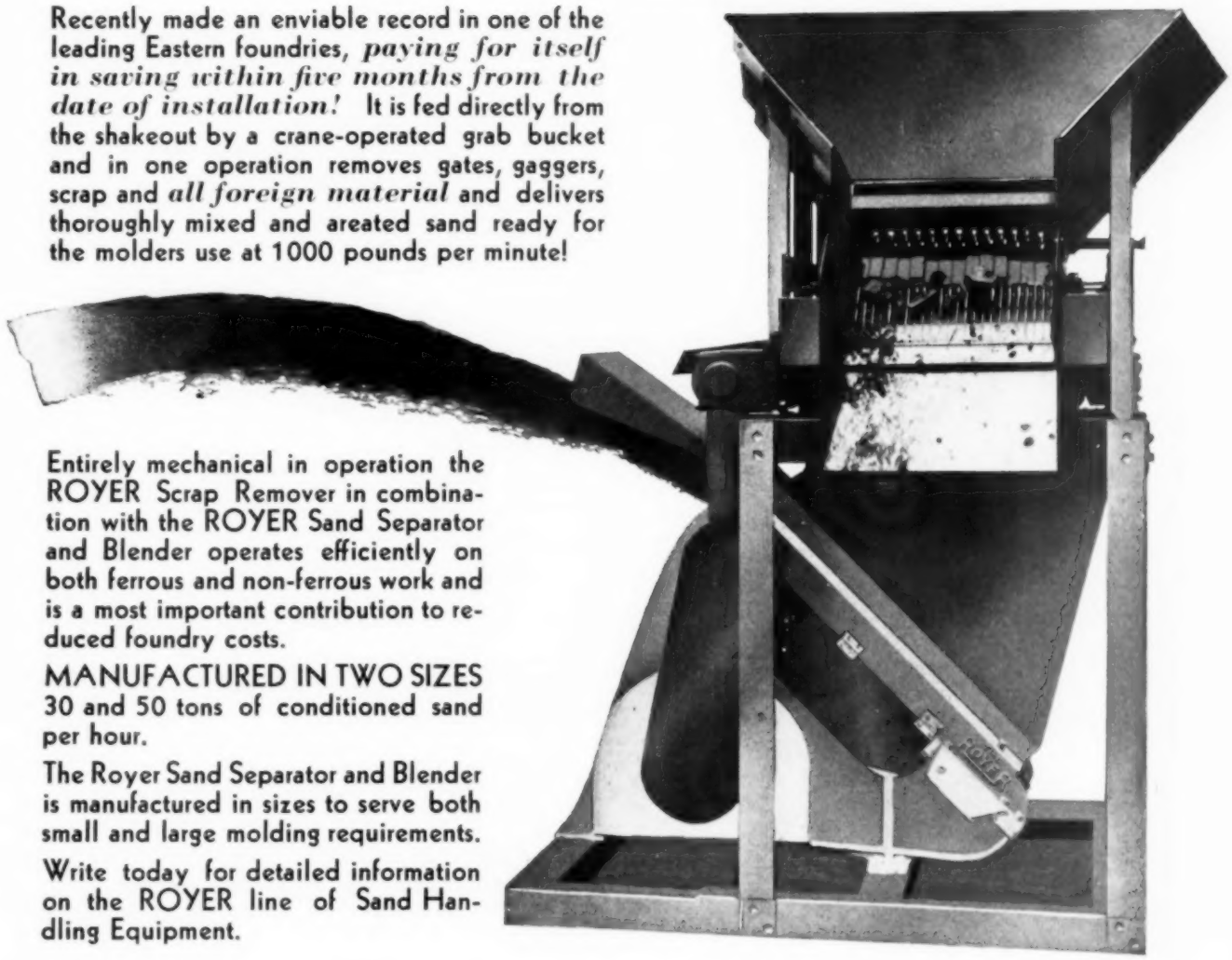

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Humidity and Oil Sand Cores

(*Concluded from Page* 13)

commercial core, by duplicating the conditions which produced the core of 175 pounds strength, a leaner oil-sand ratio may be used at a direct saving. The major issue then is to determine what happens during the transition of oil from liquid to film, and conditions affecting it during the change.

Extensive research work in the paint and varnish industries shows that the process of drying constitutes two major phases, irrespective of materials used and as to whether the oil is air dried or baked. These phases are:

1. Oxidation of oil to form larger, more complicated, polar molecules.
2. Orientation and association of these to form solid film. ("The Mechanism of Drying and the Aging of Oil Films" by Dr. J. S. Long, Lehigh university).

Moisture Inhibits Drying

It is further concluded by the same authority that excessive moisture or humidity in the air inhibits drying, particularly in the first phase. It may then be logically concluded that the second phase or final formation of solid film would be incomplete.

In consideration of this data, a series of uniform core tests was started in which core strengths at different baking periods were plotted. Our method of testing was to use the standard briquette of one square inch area. A standard commercial sand was used, mixed in a ratio of 75 parts of sand to one part of oil by volume. Moisture content, mixing and baking procedure have been as near constant as possible.

From each oil-sand mix, cores were baked at 1 hour, 1½ and 2 hours respectively to determine both the strength produced at different periods and effect of humidity variations on formation of film. Relative humidity values were tabulated both near the baking oven and as furnished by the U. S. weather bureau. It was found that inside humidity readings were modified somewhat and showed less abrupt changes and, since they represented the air passing through the oven, were used in our curves. However Fig. 2 shows both inside and U. S. weather bureau readings.

Fig. 1 shows the strength results of the 2 hours bake from each test blotted against relative humidity. While the 1 hour and 1½ hours breaks gave equally comparable results, we have selected and plotted the 2 hours results because they should more nearly parallel actual foundry baking. Results leave no doubt but that greater strength is produced under conditions where the oven humidity is low.

Fig. 2 shows complete strength curves of a group of selected tests as indicated in Fig. 1. Strength variations are apparent and particular attention is directed to character of the various curves. At high humidity the strength is not only low, but the oil starts to lose strength or burn out between 1½ and 2 hours. Low humidity produces greater strength at all baking periods and at 2 hours baking the maximum strength has not been reached.

Going back to our two-phase system of drying, we may conclude that perhaps excessive humidity does prevent proper initial oxidation or first phase action. It then will become apparent why we get low strength and burning out as a result of the forced completion by heat of the second phase.

The results which we have obtained with linseed oil have been duplicated with a compounded oil of the Werner G. Smith Co., as well as other representative compounded oils. We are assured that parallel conclusions can be obtained from any type of oil binder.

It is apparent from results shown in this series of tests that proper conditioning of the air passing through core ovens not only would permit the foundryman to carry the oil-sand ratio at the lowest point consistent in obtaining commercial cores, but also he would be assured of constant baking conditions. From Fig. 2 it will be observed that if cores are baked for the proper length of time to get maximum strength at low humidity, the binder will be burned out if baked the same length of time at high humidity.

We are aware of the many variable conditions existing in foundry core baking and of the fact that the data given here may be of questionable value in many shops. There are, however, foundries where core costs are a major issue and it would not seem too impracticable for a consideration of air-conditioning to the end that uniformity of cores at a minimum of binder cost might result.

Plants Operate Year Without Accidents

Forty-four plants participating in the Ohio Foundries Industrial Safety campaign, directed by Robert Hoierman, secretary, Ohio Foundries association, had no accidents during the year. Sixty-nine plants operated the first 6 months without mishap and 68 operated the second six months without an accident.

James B. Clow & Sons, Coshocton, leads the group of plants with a perfect safety record for the year, having worked 163,583 man hours without an accident. Kramer Bros. Foundry Co., Dayton, is second with 147,651 and Toledo Machine & Tool Co., Toledo, is third with 102,464. In the list of cities showing accidents, Mansfield takes the lead with 1,065,885 man hours worked with but three accidents, giving an average of 355,295 man hours worked per accident. Hubbard is second with an average of 175,230 per accident and Newcomerstown third with 135,035.

Eighteen hundred reports received during the year's campaign show accident frequency reduced almost ten per cent. With this as an incentive, the campaign is being continued with greater hopes for the ensuing year.

Book Review

Proceedings of the American Society for Testing Materials, paper, cloth or half leather, Part I 1071 pages and Part II 824 pages, 6 x 9 inches, published by the American Society for Testing Materials. Each part will be supplied by THE FOUNDRY for $5.50 in paper, $6.00 in cloth and $7.00 in half-leather, plus 15 cents postage, and in Europe by the Penton Publishing Co. Ltd., Caxton House, Westminster, London.

Part I of the proceedings contains reports of committees and the technical papers and standards appended thereto. Reports of standing, research and sectional committees which function in the field of ferrous metals, include the following subjects: Steel; cast iron, malleable iron castings; iron chromium, iron-chromium-nickel and related alloys; wrought iron; ferroalloys; heat treatment of iron and steel; corrosion of iron and steel; zinc coating of iron and steel; magnetic properties; fatigue of metals; and effect of temperature on the properties of metals.

Reports of the committees on nonferrous metals cover activities in the following fields: Corrosion of nonferrous metals and alloys; electrical-heating, electrical-resistance and electric furnace alloys; copper and copper alloys, cast and wrought; die cast metals and alloys; and light metals and alloys, cast and wrought. A paper analyzing the data on physical properties of aluminum-base die casting alloys is appended to the report on die-cast metals and alloys.

Reports in Part I also cover nonmetallic materials, including refractories, methods of testing, metallography, and nomenclature and definitions. Part II contains all of the technical papers presented at the 1932 annual meeting of the A.S.T.M., including many dealing with ferrous and nonferrous metals.

Special Steel for Castings

(*Concluded from Page* 16)

of this general kind of alloy steel used for castings, superior to the plain manganese steel, but not needed for many purposes for which the more simple variety is suited. The development resulting in specially alloying medium manganese steel is responsible largely for the fact, that one may get practically the same combination of tension-test properties from each of a fairly large number of grades of alloy cast steels.

Some of those combinations in the preceding list which include a proportion of manganese well above 1.0 per cent are capable, through selective heat treatments, of developing tension-test and impact-test values as impressive as any published, characterizing alloy steels of the earlier developed kinds that contain manganese percentages like those found in ordinary carbon steel.

Indicate Physical Properties

In the absence of quoted test figures typical of specific grades of alloy cast steels, it may be desirable to indicate some physical properties of steels that might be grouped roughly by those properties, rather than by chemical constituents. The volume of alloy-steel-casting output has grown sufficiently to make a grouping of this kind a reasonable procedure for a discussion of the present character. In 1921 the output of alloy-steel castings was less than 7.2 per cent of all steel castings made in the United States. In 1931 (a depression year characterized by materially reduced demand on the industry) the proportion of alloy-steel castings rose to more than 17.3 per cent and totaled more than 100,000 net tons.

Probably alloy-steel castings are being manufactured regularly, that, after skilfully applied heat treatments (including liquid quenching for some of the grades), fall naturally into approximately the groupings, as to average or representative tensile properties, shown in the accompanying table.

There are being produced, more or less regularly, alloy-steel castings developing yield point values up to 180,000 pounds per square inch and tensile strength values that sometimes appreciably exceed 200,000 pounds per square inch. Ductility values in these high-strength steels vary considerably because of the differing compositions and heat treatments. Reductions of area rarely go as low as 15 per cent.

To avoid misunderstanding, the author would point out that the tensile properties listed previously are not presented as rejection limits suitable for any steel that might appear to belong in a class roughly listed for the present temporary purpose. Sometimes consumers fail to distinguish between values applicable to specifications and average or typical results of tests. Naturally, producers are entitled to reasonable deviation factors in any operation essentially incapable of absolutely perfect manufacturing control, despite earnest efforts to approach perfection. Proper leeway must be allowed.

The principal reason for the author's exclusion of definite test data on separate cast alloy steels lies in the fact that a large amount of such data in detail have lately been made available to the technical world through the symposium on steel castings, held by the American Society for Testing Materials and the American Foundrymen's association.

Unquestionably these are days that will go down in history as constituting an enforced era of economy. It is cost in the long run that, in the tremendous majority of cases, is the factor of significance in the selection of the industrial metals. A mechanical engineer must be guided by the actualities as to first cost and by the probabilities as to service. Both elements of expense require careful study in the procurement of special- or alloy-steel castings. The wise consumer who is economy conscious will do well to listen attentively to the suggestion of the experienced foundryman, before restrictively designating any variety of alloy steel for a special purpose.

It is fortunate for those who make steel castings that they are faced with nothing in the nature of undesired restrictions in chemical composition. On the contrary, they are free to employ countless combinations of potentially useful elements that, after properly chosen and applied heat treatments, provide properties in the steel casting that make the industry identified with its manufacture one of outstanding promise.

Representative Tensile Properties

Yield point per sq. in., pound	58,000	64,000	75,000	100,000	125,000
Tensile strength per sq. in., pound	88,000	94,000	105,000	125,000	150,000
Elongation in 2 in., per cent	22	20	18	15	12
Reduction of area, per cent	44	40	36	30	24

This is the second of two articles from the paper presented by Mr. Bull at the A. S. M. E. meeting in New York. The first appeared in the January issue.—The Editors.

Addresses Wisconsin Foundry Group

Dr. Edward G. Meiter, director industrial hygiene laboratory, Employers Mutual Liability Insurance Co., addressed the Wisconsin Gray Iron Foundry group at a regular meeting held Wednesday, Jan. 18, at the Hotel Schroeder, Milwaukee, on "The Dust Problem in the Foundry Industry."

Book Review

The Metals, by A. Frederick Collins, cloth, 310 pages, 5 x 7½ inches, published by D. Appleton & Co., and supplied by The Foundry for $2.00 plus 15 cents postage and in Europe by the Penton Publishing Co., Ltd., Caxton House, Westminster, London.

This elemental handbook, designed for the layman, presents a story of the world's metals, their alloys, amalgams and compounds. The first chapter is devoted to a story of the age before metals, and then the discovery which has done so much to change civilization. This is followed by a discussion of the common metals, those which are most plentiful in nature, the cheapest or the most widely used. Into this classification falls iron, referred to by the author as the most useful metal, copper, tin, lead, zinc, nickel, tungsten, chromium, mercury, aluminum, cobalt, antimony and bismuth.

Other chapters are devoted to the noble metals, the alkali metals, the alkaline earth metals, the uncommon metals, the hypothetical metals, the older alloys, the newer alloys, amalgams, how metals are mined, extracting metals from their ores, and the uses of metals. Many alloys mentioned under older newer alloys are utilized in the castings industry.

Talks on Cupola

J. W. Hurley, chief engineer, Griffin Engineering Co., Chicago, addressed the regular meeting of the New Jersey Foundrymen's association held at the Steuben Ratskeller, Newark, N. J., Wednesday, Jan. 25. Mr. Hurley spoke on the "Hot Blast Cupola."

Warner R. Thompson Co., Detroit, has removed its offices from 407 Curtiss building to 7328 Hamilton avenue where larger quarters are available.

Effect of Alloys on Cast Iron

(*Concluded from Page 25*)

air furnace or an electric furnace is necessary if ductility of these high chrome cast irons is essential because the high carbon usually obtained in the cupola is considerably above the 2 per cent required. There are several foundries in this locality where both iron and steel castings are produced and it would not be difficult to make a 2 per cent carbon cast iron by mixing molten steel and iron in the ladle. The chromium could be introduced through the use of the briquetted alloy in the cupola.

Some iron castings are subjected to alternate thermal stresses with the result that the iron grows and may cause trouble if this expansion cannot be corrected by mechanical adjustments in the machine in which the casting is used. Such growth is caused by the influx of oxygen along the graphite planes, which oxidizes the metal. The iron oxide so formed occupies more space than the original iron, consequently, some expansion must take place. Engineers in our laboratory have found that an addition of 0.50 per cent chrome to an iron containing 2.50 per cent silicon will limit the growth under repeated heatings to one-third of that obtained with no chrome while an addition of 0.80 per cent chrome will limit the growth to one-fifth.

Increases Strength

Chrome commonly is introduced to increase strength of cast iron or to improve resistance to abrasion without developing a brittle structure. To obtain such results satisfactorily the chrome addition should be based on the combined carbon in the cast iron, adding enough to raise the percentage of that constituent to about 0.85 per cent. Ordinarily, one point of chrome will raise the combined carbon 0.015 per cent and at the same time lower graphitic carbon by an equal amount. Such an addition will develop a large proportion of pearlite in the iron which may be improved further by conversion to sorbite through a simultaneous addition of about one and a half to two times as much nickel.

Nickel, which is used with chromium to improve physical properties of gray iron, imparts certain physical characteristics when added alone. Primarily it dissolves in the ferrite but also affects the combined carbon in that it acts as a graphitizer. It is frequently used to prevent formation of white iron in thin sections where a low silicon is desirable for other reasons. It may be assumed roughly that nickel is one-half as effective as silicon where its effect as a graphitizer is concerned. Effect of nickel is more pronounced when the combined carbon is above 0.50 per cent. Higher percentages of nickel lower the transformation point of cast iron and it is quite possible to add enough of that element to form martensite, a hard constituent.

Copper confers a certain amount of oxidation resistance to iron. It has some slight graphitizing effect and its most useful application has been in combination with molybdenum in the development of an acid resisting malleable iron.

When vanadium is added to cast iron it combines not only with carbon but also with the ferrite. It is a distinct hardening and toughening agent and when added to a white iron the chill is deeper, stronger, tougher and less liable to spall under high temperatures while at the same time the iron is more easy to file or grind. Irons treated with vanadium are more resistant to shock and abrasion. Unquestionably part of this improvement is due to its effect as a cleansing agent. Usually, an addition of 0.05 to 0.15 per cent is sufficient to show that improvement.

Other alloys, such as titanium and zirconium, have been used in cast iron as softening agents. Addition of either one usually will reduce the size of the graphite flakes and increase the tensile strength 5000 to 10,000 pounds per square inch. In a recent test enough zirconium was added to the spout to introduce 0.16 per cent zirconium and the resulting castings exhibited an increased resistance to hydrostatic pressure. In the case of a 12-inch gate valve cast from that iron the hydraulic pressure could be increased to 900 pounds per square inch before leaking whereas the maximum pressure in a casting without zirconium treatment varied between 700 and 800 pounds, with 800 pounds considered unusual. In additional tests on 8-inch globe valves the foundry reported that the pressure could be increased from a maximum of 2000 pounds per square inch without zirconium to 2300 pounds per square inch where the zirconium treatment was used.

Use of molybdenum as an alloying agent in cast iron has been growing rapidly in recent years. It is particularly beneficial where resistance to abrasion is desired such as that met in sheet finishing mill rolls, contrifused brake drums and other castings subjected to sliding friction. When added to the iron it unites with both the ferrite and carbon so that it combines some of the effects of both nickel and chromium. Molybdenum is also combined with nickel and chrome in the manufacture of rolls. The following analysis of a 30-inch chilled iron roll showed a hardness of 75 scleroscope: total carbon 3.70 per cent, silicon 1.06 per cent, chrome 1.94 per cent, molybdenum 0.24 per cent, nickel 0.37 per cent sulphur 0.13 per cent, phosphorus 0.367 per cent and manganese 0.26 per cent.

To regulate chemical analysis briquetted alloys have been tested and used in increasing quantities. Briquets produced in this country contain a known weight of silicon or manganese and silicon and consist of the ferroalloy bound together with a cement binder which is of sufficient strength to resist rough handling on the cupola platform and the briquets are of sufficient weight to hold their position in the charge while descending through the cupola. As each briquent contains exact units of the metallic element, additions are made by simply adding the correct number to the charge. The alloy in the briquet does not melt until the briquet enters the melting zone of the cupola, at which time small drops of the alloy coated with a part of the binder are released from the briquet as it disintegrates and drop into the hearth of the cupola, alloying with the liquid iron.

Alloying Iron

A SYSTEMATIC application of definite principles is necessary in the use of alloying elements in cast iron, if the maximum utility is to be realized from the resulting casting. This article, which is from a paper presented at a recent meeting of the Pittsburgh Foundrymen's association in Pittsburgh, outlines the principal alloying agents commonly used in the foundry, either separately or in combination.

Explains Treatment Of Aluminum Castings

The general meeting of the Detroit Foundrymen's association, Jan. 19, featured an address by H. J. Deutsch, metallurgist, United States Aluminum Co., Detroit. Mr. Deutsch explained the fundamental theories and practical application of heat treatment to aluminum castings. Dan M. Avey, editor, THE FOUNDRY, spoke briefly on the business outlook in the foundry industry. Peter W. Mulder, Almont Mfg. Co., Imlay City, Mich., president of the association, presided. Special entertainment was provided by Matt P. Drennan, Sand Products Corp., Detroit.

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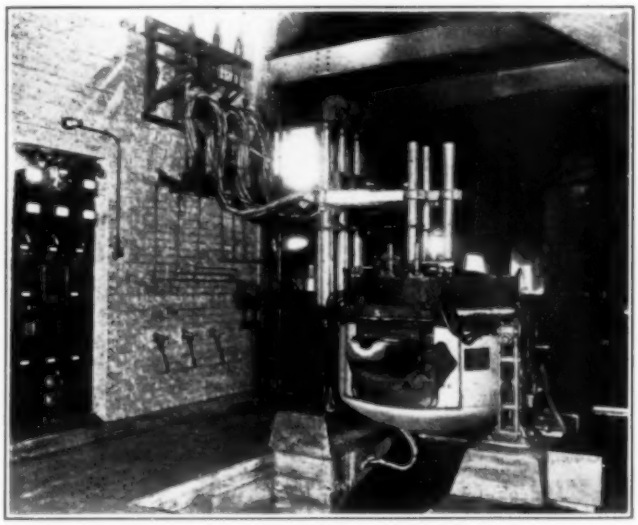

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The boy mounts the first rung on the ladder of fame

The Adventures of Bill

BY PAT DWYER

GLANCING more or less idly through the paper this morning I read a touching (press agent) little story regarding a widely known screen and stage celebrity. The writer of the story just happened by the merest accident to stroll into the star's dressing room and there found our hero seated between two tables. One large table was covered knee deep with letters. The other table, a little dinky affair supported by a single leg in the center, held half a dozen letters.

To our inquiring reporter's earnest plea for enlightenment, the idol of the public explained that the first table carried his fan mail which he never opened or read. Several secretaries attended to that. He was not interested. The second table—Ah, the second table! Now my friend take off your shoes and tread softly. We are approaching holy ground. Here is a territory to be approached with respect and caution, yea, with awe and reverence.

The second table was reserved for what the recipient wittily described as his pan mail. "And believe me kid," he is reported to have exclaimed "I put on my sharpest pair of spectacles and read each one of the letters with the greatest care." Believe it or not, there's the story and you can accept as little or as much as you please, even as I did.

Fortunately, or unfortunately—opinions differ on this point—my combined fan and pan mail is not so heavy that I cannot attend to it personally. In fact at times the stream is so light, that I can indulge in the luxury of scanning the post mark and the handwriting and thus settle the identity of the writer as a friend or stranger, before I open the envelope. Thus when I saw Battle Creek post marked on an envelope a couple of weeks ago, and further when I noted the bold, round hand writing, I knew as well as if I had seen him walking into my den that here was my old friend Wm. Titherington, himself, as represented by what the old boys were wont to describe as his stopping place and his hand o' write.

Temporarily at liberty, in the theatrical sense, William had seized the opportunity to carry on a long distance discussion on the merits of a certain method for molding a roller casting. He deplored the fact that many ingenious shop kinks and short cut methods are disappearing with the vanishing molder and—Well, read the letter for yourself:

Whenever you or Bill refers to some of the clever stunts practiced in the past by old time foundrymen, you bring back happy memories to us who as apprentices were fortunate enough to have been associated with these artists. They are pretty well faded out now. They have taken their skill and their talents with them and only a few of their masterpieces ever have been recorded.

In the shop where I served my apprenticeship an ingenous trick o' the trade was practiced every day on a certain casting and I always have been surprised that the idea has not been adopted more widely. In the 25 years that have elapsed since I left the old *alma mater* I never have seen the idea in practice. Perhaps I am overestimating the value of this little shop kink, but it certainly saved a good many dollars in the plant where first I saw it used. I am attaching a sketch to illustrate the principal features.

The casting is a roller for a clay grinding machine and functions in a somewhat similar manner to the rollers in foundry facing sand mixers. The weight is about 2 tons and although the dimensions on the sketch are from memory, they are fairly accurate. However, accuracy of dimension is not a factor in the following problem:

The lightener core had neither teats nor prints to connect it with the face of the mold. The core remained in place until the casting outlived its usefullness and was broken up for scrap. A few chaplets top and bottom constituted the only points of contact between the core and the mold. Regular core sand mixture was used for the core which received no special treatment. The

I think that I shall never see an actor half as good as me!

metal always came up into the risers quietly. So far as my recollection goes, none of these castings ever was defective. In fact not a mark appeared on the surface to indicate that the core caused any agitation in the metal.

Now the question is, how did the molder take the vent from the core?

You probably have seen a hit or miss method sometimes used where a piece of pipe stuck in the core is aimed at a hole in the cope. After a great deal of fussing and fitting, including a generous reaming of the hole in the cope, the cope finally is closed down over core and drag. Waste is packed around the pipe and the remainder of the hole in the cope is filled with sand gently tucked into place.

These pipes were not always dependable, particularly when they were designed to serve as chaplets in addition to their primary purpose of vent channels. They might collapse or crack and allow the metal to flow into the vent passage. The lower end might sink under pressure and permit the core to rise. The unsatisfactory method of packing waste and sand around the pipe in the cope left unsightly lumps to be chipped from the casting.

Old time molders had a quicker, cleaner and surer method for anchoring the core and providing a passage for the vent. This method left no pipes, lumps or other excrescences to be trimmed from the face of the casting. Show this to Bill and ask him what he thinks about it.

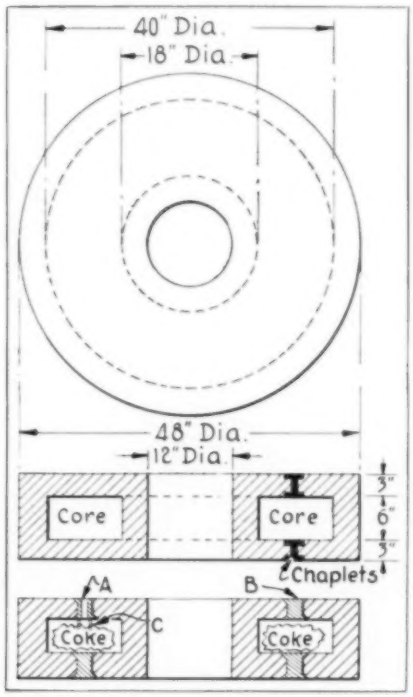
Naturally my professional curiosity was aroused, particularly by the statement that the core positively has no prints or outside connection of any kind whereby the vent and later the core itself might be removed from the casting. The only connection between core and mold is the chaplets or anchors to secure and support the core above and below. The accompanying sketch showed ordinary double head, solid stem chaplets between core and mold.

Under the conditions outlined I was forced to admit that I did not know the answer. When I asked Bill about it he said that in the shape the problem was presented it was impossible of solution.

"You can't pour iron around a core, so that the core is entirely enclosed. If no vent passage is provided, the vent will make a passage or a multiplicity of passages for itself all through the iron. The volume of gas generated in a core at high temperature is sufficient to build up a pressure that will break through a much stronger envelope than a few inches of molten iron.

"If the chaplets are provided with an opening through the center, of course, that is another story. You better write to William and tell him that if he insists on using solid chaplets, neither you nor I can find any answer for his problem. In fact the two of us together can't do it. However, we're always open to conviction and will be glad to learn how the vent is taken from a core entirely surrounded by a 3-inch thickness of molten iron.

"That last clause" Bill remarked complacently "will save our face in the event that Wm. has dug up one of the lost arts like tempering copper or capturing moonshine. I have heard many wonderful stories of Battle Creek, some of them positive miracles, and although reason and experience warn me that a ventless core and a wild wildcat are sisters under the skin, still as I said before, let us withhold final opinion until all the evidence is in.



The vent from the core escaped through three of the six chaplets as shown in the bottom view

"Give my love to Bill when you write" he added as an after thought "and you might ask him if he remembers the night in Milwaukee—"

His reference to Milwaukee lies far outside the point at issue and I see no reason for inserting it in this veracious chronicle. I wrote briefly to William outlining our doubt and hesitation in accepting his statement that the core in a large roller casting did not touch the face of the mold at any point. Our objection of course based on the fact that the gas from the core had to escape through some channel. This letter brought the following reply:

I am greatly pleased to find that your professional curiosity, also that of that hardened old Philistine Bill has been aroused by my reference to how a difficult situation was handled by the old timers. You know and I know there were plenty of first rate ideas in use by the old boys that would prove profitable to present day foundrymen if they were known and practiced. With the attached sketch in one hand and my former letter in the other hand you will have all the information necessary to understand how this seeming miracle was accomplished. As Bill hinted at the time you brought the subject to his attention, the vent from the core was taken off through hollow chaplets. In the amended illustration you will note that the center of the core is filled with coke. At three equidistant points *C* a short piece of pipe with one end buried in the coke and the upper end flush with the top face of the core, served as an outlet for the gas generated at the time the core was surrounded by molten metal. Three cast iron stool chaplets *A* were placed over the three short pieces of pipe. A hole in the center of each chaplet served as a continuation of the short pipe leading to the coke heart of the core.

"There" I said "that clears up the general situation in a highly satisfactory manner. That which was a mystery is a mystery no longer. The trick is rather clever and as Wm. says one may wonder why it is not practiced more extensively, either in the original or in a modified form."

"Well" said Bill "I'll tell you. In the olden days when men were men and trusted each other, you could get away with selling a man a casting from which the core was not removed. Of course in those days a casting was sold, as it were, on the hoof and so long as it served his purpose and did not cost too much, the customer did not care whether the inside was filled with sand, air or horse feathers. Today, the customer in person or by deputy would examine a similar casting inside and out and if he found as much sand on the inside as would go in the eye of a camel or a needle or something like that, he would lift up his voice louder than the combined wail of forty camels and demand a reduction in the price.

"Where the old time atmosphere can be approximated, that is where the customer and the foundryman are on intimate terms and each understands the practical details of his own business, this feature of leaving the core in the casting can be settled satisfactorily by mutual approval before the job is started. However, in recent years with establishments constantly increasing in size and with authority in various degrees delegated to assistants and assistants to the assistants, the principals rarely have an opportunity of getting together to effect some friendly compromises.

"Ah! I see by your glowering eye that my spontaneous comments are not appreciated at their true worth. If it is a fair question, what's wrong with 'em?"

"Nothing " I said "except that they are totally irrelevant to the point at issue and you might at least have waited until I finished reading the

(*Concluded on Page* 61)

Science Perfects Bell Making

(*Concluded from Page* 17)

making bells for almost 100 years. In addition to having a most complete bell foundry the company, up to about 5 years ago, was credited with making the largest swinging church bell in the world. This bell still hangs in the tower of the St. Francis de Sales church in Cincinnati, and weighs about 35,000 pounds. The world's largest bell of any type is the one that was cast in Moscow in 1793 and weighs 440,000 pounds.

Bells are made from an alloy of copper and tin. The standard composition of swinging bells is 80 per cent copper and 20 per cent tin. In stationary bells the composition is 78 per cent copper and 22 per cent tin with a slight variation to meet certain conditions.

Fig. 3—Gas fired melting furnaces in which the bell metal is melted

The original design of a bell rules its tone. While it can be tuned by grinding metal off here and there as shown in Fig. 2, that process is limited. The two major factors in bell design, aside from metal composition, are shape of the bell outline and thickness, which varies with the curve of the bell. In other words the ratio of change in thickness and sweep, from the upper part of the bell to the mouth and the relations of these changes to each other definitely control the ultimate tone qualities.

Drag Includes the Core

The pattern made, the next steps in producing a bell consist of making and baking the mold, pouring the molten metal, removing the casting from the mold and then tuning. As in ordinary practice a flask is made up consisting of cope and drag, except that the drag also includes the core in this case. The cope is built up in cast iron sections bolted together or in a single perforated casting which has the general shape of the bell. The cope is inverted and the molding sand is applied to the form and shaped with a strickle board, one end of which is affixed to the bottom of the form as it stands and the other is centered at the top by an arm and bracket. The molder can swing or sweep the strickle board in a circle, thus reproducing the bell contour with great fidelity.

The combined drag and core is made similarly. Molding sand is applied to the outside of the core form and shaped with a strickle board of the reverse contour to the board used on the cope form. Strickle boards are shown on the molds and on the wall in Fig. 1. The space between the core and the cope, when fitted together, determines the wall thickness of the bell. Molds are baked or dried in gas fired core ovens, shown in Fig. 1. This process requires several days, one day for each layer of molding sand used. The open ends face each other and a single track extends through both furnace and the span between.

Each oven is 14 feet long, 7 feet high and 8 feet wide, and is heated with two drilled gas pipe burners which run the full length of the oven and set on the oven floor. The car top consists of a series of cast iron bars and the cores rest directly on these bars. Copes are inverted and rest on stands. When the molds are dried they are removed from the ovens, fitted and clamped together on the molding floor. A view of the molds clamped together is shown on the cover of this issue. Of course there are intermediate operations such as giving the molds a finishing coat, blackening them with plumbago, etc. Inscriptions and decorations are made up on a separate form and pressed into the surface of the cope, thereby embossing them on the surface of the bell.

Melting is accomplished in gas fired furnaces of the reverberatory, tilting and crucible types. The reverberatory furnace is of brick, 20 feet long, 5 feet high and 5 feet wide, with an 80 foot stack and heat is applied with gas burners. Stock bells run as high as 7000 pounds, the capacity of this furnace, and anything larger is considered a special order. The two tilting type furnaces are of 500 pounds capacity each and are fired with individual gas burners. Gas and air are premixed for complete combustion, the motor driven blower mixer being bolted direct to the furnace so that the combustible mixture is forced into the burner through a flexible coupling.

Little Finishing Necessary

Three crucible furnaces are set in a pit and are heated with a single gas burner each. The three gas burners take off from the same manifold and a gas-air mixture is supplied by a single premixing machine similar to the ones on the tilting furnaces. When pouring a bell the metal is run off from one of these furnaces into a ladle which is carried to the molding floor, either by hand or by crane, depending on the size of the bell. Bells are poured from the top or small ends of the molds and except for trimming off the gate and header there is little finishing to be done owing to the original smoothness of the molds. These bells afterward are given a bright finish by a machine developed in the foundry. This plant has two pouring floors and a complete machine shop.

For tuning, the bell is removed to another department and rigidly clamped in an inverted position on a rotating table, as shown in Fig. 2. A motor-driven grinding wheel is bolted to the end of an arm that may be moved in any direction so that the tuner can grind off the thickness of metal at any point desired, or from the entire inner surface. After each grinding operation the tuner sounds the bell with a mallet and compares the tone of the bell with a tuning fork held at his ear.

Michigan State Plans Short Course

A short course in foundry work will be held at Michigan State college, Lansing, Mich., April 6 to 8. The program will consist of a number of papers and discussions on gray iron, nonferrous and sand problems by numerous authorities on the various subjects. A complete program will be announced later.

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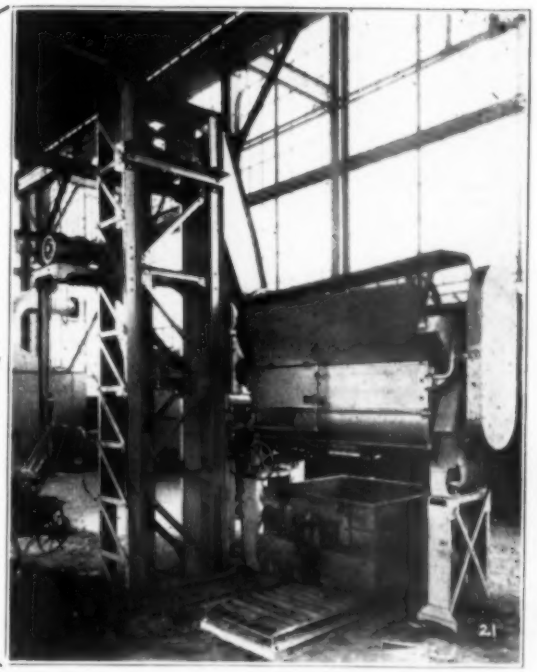

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Control Features Steel Foundry

(*Concluded from page 22*)

all of the fines in reclaiming the sand, but does attempt to maintain the fines at one level constantly. A storage bin receives the reclaimed sand from the screen.

Sand is discharged from the storage bin into a skip loader, in which the mixtures of sand, clay and cereal binder are prepared. The skip loader elevates the mix and deposits it in a batch mixer, where it is mixed dry. The sand then is dumped into a muller type mixer, shown in Fig. 9, and the water is added. The special device shown in the foreground of the accompanying illustration, has been developed to unload the muller type mixer and deposit the sand in the large container in the pit. The sand is carried in that container to the molding floors in the heavy shop.

Backing sand is prepared by a sand cutting machine, made by the American Foundry Equipment Co., Mishawaka, Ind., and is handled to the molding floors by one of the four cranes serving the main bay.

Has Two Main Floors

Cores needed in the large and small foundry are made in a special department located in one corner of the heavy shop. The cores are made chiefly by hand, although stock cylindrical cores are made by an extrusion type machine. Cores are baked in a drawer type oven made by Young Brothers Co., Detroit, and four car type ovens installed by Holcroft & Co., Detroit.

The heavy shop is divided into two main floors, one devoted to the manufacture of railway car work, furnace parts and other castings which lend themselves readily to production with matchboards on roll-over pattern draw molding machines built by the Herman Pneumatic Machine Co., Zelienople, Pa., and the other to a general line of castings molded chiefly with a sand slinging machine supplied by the Beardsley & Piper Co., Chicago.

Two molding machines of a battery of four, used for railway work, etc., are shown in Fig. 10. These machines operate in pairs, the one in the background at the right produces the drags, while the machine at the left is used for the copes. In operation, facing sand is shoveled into the flask from the bin shown in the center of the illustration, and backing sand drops from the bin above directly into the flask. The sand is jolted, the flask and matchboard rolled over so that the bottomboard rests on the roller conveyors, and the pattern is drawn. Nails are placed, the cores are set, and the drag is moved down the conveyors until it is in front of the machine shown in the foreground. A cope made on that molding machine then is swung from the machine on the jib crane and is set in place on the drag mold.

An interesting rig has been developed to handle the molds from the conveyors to the pouring floor a short distance away. Two separate sections of conveyors lead from the drag machine to a short distance beyond the cope machine, thus providing an open space between. The bottom board is so constructed that one cleat on the bottom rests on each of the two conveyors. Two T rails are fastened together with cross members and are spaced far enough apart so that the assembly will just fit in the space between the conveyors. The crane deposits a rail assembly between the conveyors before the molds move down, and when four, five or six molds are over the rail carrier, depending upon the size of the molds, a sling on the crane is hooked to the rings on the ends of the rails and the molds are picked off the conveyor and deposited on the pouring floor. The end of the rail carrier with the hooks is shown in position between the conveyors in the inset of Fig. 10.

The sandslinging machine is the locomotive type and operates on a track about 125 feet long, as shown in Fig. 6. At the present time the machine operates only on one side of the line of supporting columns, but later the company anticipates rearranging the cleaning room for the heavy shop, which is on the other side of the columns, and using both sides for molding purposes. The machine operates at two speeds, a high speed being used for dry sand molding and a low speed for green sand work. The slow speed for green sand molding results in soft ramming and therefore provides greater permeability. The sandslinging machine is used only for the backing sand, the facing sand being applied by hand. The same mixture of backing sand is used for both green and dry sand work.

Several types of chills are used, including horse shoe nails, big headed nails and coil chills. Coil spring chills are employed on heavier sections and the lighter parts are chilled by the horse shoe nails. Big headed nails are used extensively in front of gates to keep the incoming metal from washing the sand at that point. On larger jobs, the cope is nailed thoroughly to keep the sand from falling at the time of pouring.

Molds are dried in coke fired, car type ovens. Three ovens are provided for the purpose, one being twice as large as the others to accommodate the larger work. The molds are brought to a temperature of 600 degrees Fahr. and held at that temperature for 4 hours. The length of time that the mold is in the oven depends, of course, upon the size which in turn governs the time required to bring the mold to the maximum temperature. Molds are poured while still warm from the furnace.

An interesting method of pouring, which is termed a partial reversal, is used on practically all long work, except that which is too heavy or too long to reverse. A general idea of the arrangement of mold and other equipment may be secured from Fig. 7. As shown, a cleat centered on the bottom board rests on a T rail supported on the floor. In the pouring position, the mold has the opposite end down from that shown in the illustration. This provides uphill pouring with its various advantages. As soon as the casting has been poured, the flask is reversed, and a block under the high end holds it in that position. Then the gate becomes a riser and feeds the hotest metal in the mold into those sections which are cooling and shrinking. A flow off riser is employed on the opposite end from the gate.

Metal May Be Transferred

Under normal operations the heavy shop has a capacity of 700 tons of castings a month. The shop is equipped with two 20-ton open-hearth furnaces located along one side of the building about half way between the two ends. In addition, a track connects the small castings shop with the heavy foundry, so that a ladle of metal from the electric furnace may be transferred quickly to the heavy shop. Castings ranging in weight from a few pounds to 18 or 20 tons are poured in that department.

After being shaken out, castings are taken to the far end of the shop and sandblasted. The risers then are removed, the castings are chipped, ground and inspected and then are ready for heat treatment. The furnaces for heat treating large castings are of special design and were built by Holcroft & Co., Detroit. As shown in Fig. 11, the furnace really consists of four separate divisions, all connected by the transfer track. Castings are loaded on a car when it is located in the immediate foreground. The oven at the right is the heating chamber and is oil fired. The chamber at the left is the enclosed cooling compartment where slow cooling may be secured. When an air quench is desired, the doors in the back may be opened and the car with the castings may be pushed out of doors. Two cars are used in the system, so that one may be loaded while the other is in the oven. The arrangement of the loading, heating and cooling compart-

ments has been especially adaptable for the type of work produced by the Detroit Steel Casting Company. The furnace responds readily to automatic temperature control and produces uniformly satisfactory results.

Careful research and accurate control of shop practices are essential for producing the best results in heat treating castings. To secure that the company has installed in its laboratory a new, automatically controlled electric heat treating furnace. Careful research constantly is carried on with this furnace and through its operation, the shop furnaces are controlled.

The Detroit Steel Casting Co., produces a wide variety of work, and to simplify the problem of its customers in ordering castings, recently established five general classifications for its product. A discussion of these specifications will appear in an early issue as part three of this series.

Sees Radical Stand Necessary

(*Concluded from page* 23)

Dodge Steel Co., Philadelphia, pointed to the fact that 80 per cent of the population of America depend upon business or industry for their livelihood. Consequently, the constant demand for lower and lower prices reacts directly upon the buying power, the welfare and the existence of a large proportion of the people. A buying policy that constantly seeks to drive down prices, cannot but react sooner or later upon buyer as well as seller in every transaction. Selfish fear which dictates a buying policy that permits purchases at prices known to be below costs, is in the last analysis, self-destructive. The recognition of this fact is the first step in recovery for all industry.

The discussion which followed demonstrated that the seller is not alone in intensifying the competitive pressure. The buyer often is the aggressor through his own purchasing department, while in his sales relationships he decries practices that he condones in his own establishment.

The following officers were elected for the ensuing year: President, Theodore H. Harvey, Ohio Steel Foundry Co., Lima, O.; (see page 35); vice presidents, G. R. Casey, Treadwell Engineering Co., Easton, Pa.; E. L. Brooks, Sawbrook Steel Casting Co., Cincinnati, O.; F. A. Lorenze Jr., American Steel Foundries, Chicago; H. E. Muchnic, Locomotive Finished Material Co., Atchison, Kansas; R. E. Noak, Monarch Foundry & Engineering Co. Ltd., Stockton, Calif.

The following directors were chosen: Keith Williams, Pratt & Letchworth, Buffalo; W. E. Trump, Machined Steel Casting Co., Alliance, O; Arthur Simonson, Falk Corp., Milwaukee; E. S. Dilley, Standard Brake Shoe & Foundry Co., Pine Bluff, Ark.

The Adventures Of Bill

(*Concluded from page* 57)

communication from our worthy brother in Battle Creek."

"Your pardon, dear lad" Bill pleaded contritely "I did not know you were holding out part of the letter. How does William bring his epistle to a close?"

"Quite properly he refers briefly to the manner in which the chaplets are applied. The mold is made in dry sand and that provides a firm surface for the chaplets in the drag and in the cope. Six solid chaplets support the core on the bottom. Three solid chaplets and three hollow chaplets anchor the core on the top. A small clay worm on the top and another on the bottom form a seal between the chaplet and the opposing surfaces of mold and core. The core is set in such a manner that the vent chaplet will touch a point in the cope clear of any bar or other obstruction. The cope is tried on and off and a vent hole is bored in the sand immediately above the impression left on the surface by a pinch of flour on top of each chaplet."

"Is that all?"

"Well, practically, yes. Except you choose to take his final statement home with you and think it over in connection with your sons. The youngest apprentice, about 15 years of age working on a little bench, made the molds for these spool chaplets. He puffed out his little chest and considered himself quite an expert, rolling the flask twice to make a 3-part job in a 2-part flask. Tough little devils in those days, eh?"

Book Review

The Development of American Industries, planned and edited by John George Glover and William Bouck Cornell, imitation leather, 932 pages, 6 x 9 inches, published by Prentice-Hall, Inc., and supplied by THE FOUNDRY for $5.00 plus 15 cents postage and in Europe by the Penton Publishing Co., Ltd., Caxton House, Westminster, London.

The economic significance of a group of leading American industries is discussed in this volume. Since an authoritative and adequate treatment of such a broad subject, namely the development of each of 39 major industries, requires a knowledge of a vast amount of detail, co-operation of industries, prominent trade associations and leading industrial concerns was secured. As a result, the editors point out that each chapter in the book is the joint product of some of the best minds in the particular industry covered and is a scholarly and accurate history of the industry.

The text opens with a discussion of "Labor's Contribution to American Industries" by William Green. This is followed by chapters dealing with the industry devoted to each of the following: Agriculture, meat packing, fishing, lumber, pulp and paper, book publishing, newspapers, textiles, cotton growing, rubber, leather, sugar, petroleum, coal, iron and steel, copper, lead, zinc, glass, plate glass, cement, chemical, paint, varnish and lacquer, machine tools, electricity, power, shipbuilding and shipping, railroads, automobiles, aeronautics, telegraphy, telephones, motion pictures, radio, retailing, hotels, travel, banking and trade associations.

Study Gating of Nonferrous Castings

A round table discussion on gating problems featured the January meeting of the Connecticut Nonferrous Foundrymen's association held at the Hotel Garde, New Haven, Conn., Jan. 9. The discussion was practically a continuation of that which developed at the November meeting on the same subject.

C. H. Blanchard, Reading Pratt & Cady Co., Hartford, Conn., presided. R. C. Miller, representative Osborn Mfg. Co., Cleveland, will address the group at the March meeting.

Heads Norton Co.

Aldus C. Higgins (see FOUNDRY Alubum, page 34) was elected president and general manager of the Norton Co., Worcester, Mass., recently. Mr. Higgins is a son of one of the founders of the Norton Co., and has been connected with that organization since 1919 in various executive capacities. He first became connected with the research laboratory and subsequently became manager of the research and abrasive plants. While serving as head of those departments, Mr. Higgins developed an electric furnace for the fusion of abrasives for which he was awarded the John Scott medal.

Mr. Higgins was elected secretary of the company in 1912 and was named treasurer in 1919. He also became general counsel.

Holds Annual Party

The first annual New Year's party of the Philadelphia Foundrymen's association was held at the North east Shrine club, Philadelphia, on January 11. Professional entertainment was provided for the party.

Handling Materials in Brass Shop

(*Concluded from Page* 29)

cope and drag. Furthermore, the most satisfactory mold size, from the standpoint of convenience of handling, is 10 x 14 inches, with up to 4 inches cope and drag.

The complete sand-preparation and sand-handling unit is so constructed that it can be inspected and maintained easily. All overhead equipment is accessible from a walk-way that extends the length of the conveyor. The underground equipment has lighted walk-ways along its entire length. This not only facilitates repairs, but enables the pits to be kept clean.

Moving units are equipped with individual drives and, except for a belt drive on the vibrating screen and a direct motor-drive on the aerator, herringbone-gear speed reducers are used. All moving parts are equipped with grease fittings, and the bearings are protected from sand and dust.

The sand handling equipment is controlled from a pushbutton panel with pilot lights for each unit. All units of the prepared-sand and shakeout-sand systems are electrically interlocked so that no material may be conveyed until all units are in operation. This prevents sand from piling up at any point should one unit stop.

Since the functioning of the unit depends on the uniformity of molding sand, it was necessary to introduce a control on the consistency of the sand. Accordingly, sand testing laboratory was set up having equipment conforming to standard or tentative methods of test of the American Foundrymen's association.

Limit Mixing Time

Inasmuch as uniform mixing is necessary to produce uniform results, a limit was set on the mixing time. It was found that the desired results were obtained if water was added ½ minute after the sand had been charged into the mixer and if the sand was discharged 2 minutes after the mixer had been charged. At no time is the sand allowed to remain for a longer period than 4 minutes.

To replenish losses, new sand additions are made at intervals of not less than one-half hour. Each of these charges is introduced through the openings of the shakeout system, and consists of not more than 200 pounds. By using this procedure the new sand is distributed uniformly in the storage bin and, hence, throughout the system.

A control of the consistency of the sand has proved of great advantage in controlling the quality of product. Results have been manifest in a reduction of scrap due to holes, warped castings, *drops*, *blows* and *washes*. The uniform sand has enabled the molder to regulate his machine-molding practice and to use the same molding pressure day after day for a given job. The pourer also depends upon the moisture content being uniform in determining the temperature for the metal and the chill effect within the mold.

Electric rocking arc furnaces having an output of 1400 pounds per hour are used for melting the various brass alloys. With these furnaces it is possible to use considerable quantities of scrap punchings and baled copper wire in the charges. Since the atmosphere is kept free of oxygen by the burning carbons, no difficulty is experienced in regulating the mix or controlling the melt.

The complete melting equipment occupies an area of 720 square feet, all of which is located under a hood from which the hot gases and fumes are removed by an exhaust system. The quantity of air removed in this manner has a beneficial effect on the whole foundry, in that the positive circulation of air reduces greatly the quantity of dust particles.

Cast-iron plates, covered with carborundum and flush with the concrete floor, are placed between the pedestals and in front of each furnace. These plates protect the floor from spilled metal and provide good footing for the operator. A small sheet-metal deflector that can be removed easily is mounted over the furnace opening to disburse glare.

The crucibles of molten metal are conveyed from the furnace on a small dolly truck, which eliminates the hazard of spilled metal. The dolly fits between the furnace pedestals, as shown in Figure 4. When the crucible has been filled, the dolly is moved clear of the furnace. The crucible with the pouring device then is picked up on a monorail system serving the mold storage floor, each bay of which is equipped with a traveling monorail that provides accessibility to each of the pouring racks in it.

Maintain Pouring Crew

The pouring of molds is handled by experienced men, while the molders remain at their machines. Alternate molds on the storage lines are poured as shown in Fig. 2, after which the mold weights are placed on the adjacent molds and the remainder poured. The transfer of the hot mold weights is made with tongs that fit into recesses in the top of the plates, as shown in Fig. 3.

The use of such tongs greatly reduces the hazards of the manual handling operation.

Sandblasting is used for cleaning the castings because the cutting action of the sand stream removes all scale from the surfaces exposed to the direct action of the blast. Small castings are cleaned in two sandblast barrels consisting of a rotating cylinder which contains the parts and tumbles them in the path of the sand stream.

Install Equipment

FOLLOWING a study to determine a means of reducing foundry costs and securing better quality castings, the Western Electric Co., Chicago, installed continuous type equipment for sand and mold handling as well as electric furnaces of the rocking arc type. In this article, which is from a paper presented at the Detroit convention of the American Foundrymen's association, the authors describe in detail the equipment used, methods of pouring and handling molds, furnace practice and the arrangement of the cleaning room. Mr. Anderson is foundry engineer and Mr. McAuley is materials handling engineer of the Western Electric Co.

Appoints Representatives

K. J. Papke, 1012 North Third street, Milwaukee, has been appointed district engineer in charge of sales of the Despatch Oven Co., Minneapolis, in the Milwaukee territory. E. C. Buehrer, 669 Howard street, San Francisco, will represent the company in the Northern California territory. W. Glen Tipton of the Equipment Engineering Co., 210 South Penna street, Indianapolis, has been made district engineer in charge of sales of that company in central Indiana. W. F. Hebard & Co., 551 West Van Buren street, Chicago, will be in charge of sales in the Chicago territory, covering Illinois and the northwest section of Indiana.

Safety Congress

The 22nd Annual Safety congress of the National Safety council will be held at the Stevens hotel, Chicago, Oct. 2-6.

L. Arthur Dawson, formerly connected with the E. J. Woodison Co., now is associated with the Dawson-MacDonald Co., 178 Purchase street, Boston, Mass. The Dawson-Macdonald Co. specializes in foundry equipment and abrasives.

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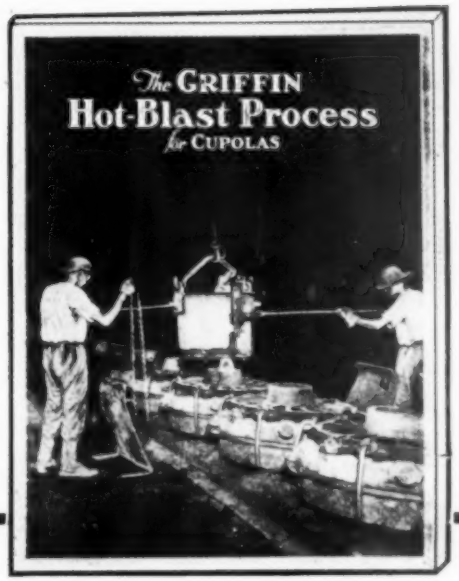

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Obituary

JOHN J. HARTLEY, Western division chief engineer, Link-Belt Co., Chicago, died recently at the age of 39. Mr. Hartley had been connected with the Link-Belt's Pershing Road plant, Chicago, for the past 23 years, having entered the company's drafting room as a boy. Following a liberal experience in both the engineering and construction departments, Mr. Hartley also served in the capacity of sales engineer and in 1929 was promoted to the position of chief engineer of the Western division. For several years he specialized in materials handling equipment for foundries.

J. J. Hartley

Walter S. Killam, 56, general manager of the Capitol Brass Co., division of the Bohn Aluminum & Brass Corp., Detroit, died recently.

Valentine C. Turner, 62, vice president and treasurer, Scully Steel Co., St. Louis, died in a St. Louis hospital recently.

Charles E. Fargo, 59, former president of the Fort Dearborn Foundry Co., Chicago, died at his home in Chicago, Jan. 9.

W. S. Cumming, for many years associated with the American Brake Shoe & Foundry Co., Chicago, in a sales capacity, died at his home in Freeport, Ill., recently.

James G. Kelly, 64, president, the Kelly Foundry Co., South Side, Pittsburgh, died Jan. 27 at his home in Pittsburgh. Mr. Kelly had been in the foundry business in Pittsburgh for more than half a century, the Kelly Foundry Co. being a producer of gray iron castings. Funeral services were held Jan. 30 in Pittsburgh.

Frank Alphonso Austin, 75, president and treasurer of the F. A. Austin Pattern Co., Syracuse, N. Y., died recently at his home in Syracuse after a long illness. Mr. Austin, in association with three partners, founded the Economy Foundry & Machine Co., in 1887 and also the Syracuse Door Hanger Co. The present Austin Company was established in 1904. Rifles and mortar shells were the main product of his companies during the Spanish-American War. During the World war, Mr. Austin again turned his factory over to the government for the manufacture of Liberty motor production patterns.

H. G. Sommerfield, president of the London branch of the Institute of British Foundrymen, and for eight years secretary of that branch, died recently. Mr. Sommerfield, proprietor of H. G. Sommerfield Ltd., conducting business in pig iron, foundry equipment and supplies, has been identified with the industry continuously since 1910. He traveled extensively and was a recognized authority on Scandinavian foundry practice. During the war he served as an officer in the Royal artillery. Mr. Sommerfield was secretary of the London branch during the world congress in 1929 and his ability and administration developed many of the notable features of that convention including the reception of foreign delegates by the Lord Mayor of London at the Guildhall. He was a vice president of the Foundry Trades, Equipment & Supplies association. He also was chairman of the finance council, was elected to the common council for the Aldersgate ward of London and held important positions on many educational bodies.

H. G. Sommerfield

Isaac H. Milliken, vice president of McConway & Torley Co., Pittsburgh, manufacturer of steel castings, died at Pittsburgh, recently. He was born in Pittsburgh 60 years ago, joined the McConway & Torley Co. when a youth, and had been identified with the company continuously since. He was a member of the Duquesne club, Pittsburgh, Manufacturers' club of Philadelphia and the Machinery club of New York, among other affiliations.

Karl F. Snow, one of the founders of C. O. Bartlett & Snow Co., Cleveland, died at Cleveland, Jan. 30. Having a natural bent for mechanics, Mr. Snow early was taken in as a partner by C. O. Bartlett, then a brick manufacturer in Cleveland. Mr. Snow held a number of patents, mostly involving processes and equipment for conveying.

Edward J. Schultz, 44, core room superintendent of the Caterpillar Tractor Co., died on Feb. 2, 1933. Mr. Schultz was well known in the automotive industry and had been connected with such firms as the E. J. Ryan Foundry, Cleveland,; Ryan & Bowen Co., Lansing, Mich.; Chevrolet Motor Co., Saginaw, Mich.; Lakey Foundry & Machine Co., Muskegon, Mich. and for the past four years has been connected in an executive capacity at the Caterpillar Tractor Co. Mr. Schultz received citation in the World War, having seen active service in the major engagements on the St. Mihiel and Meuse-Argonne fronts. Burial was at Cedar Rapids, Iowa, the place of his birth.

Council To List Industrial Laboratories

The Research Information service of the National Research council is preparing a revision of its *Industrial Research Laboratories of the United States, including Consulting Research Laboratories.* The fourth edition of the list was published in 1931 and contained over 1600 such laboratories. The council requests that any company maintaining a research laboratory which was not listed in the previous edition, request a questionnaire from the Research Information service, National Research council, Washington, so that the forthcoming bulletin, which will be available for distribution after September, may be as complete as possible.

Defines Engineering

The education research committee of the Engineering foundation, 29 West 39th street, New York, has published a pamphlet entitled "Engineering: A Career—A Culture" which has been prepared to clarify for youth the broad field of engineering.

The professional functions of the engineer are stated with the precision which accompanies intimate knowledge of engineering in theory and practice. The major division of engineering are dealt with from this standpoint, the text being "descriptive of the profession of engineering —of its spheres of action, of the training and the qualities required for its successful pursuit; of the obligations which it imposes, and the reward which it affords." A chapter is devoted to each of the major fields of engineering.

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2—Provide improved surfaces for finishing.

3—Substantially reduce compressed air cost and total blasting expense.

"CERTIFIED" STEEL ABRASIVES
reveal the "forgotten" way to PROFITS FOR 1933!

Write for Actual Operating Figures and Free Samples

ANGULAR STEEL GRIT

Reg. U. S. Pat. Off.

Manufactured only by
PITTSBURGH CRUSHED STEEL CO., PITTSBURGH, PA.
STEEL SHOT AND GRIT CO., AMESBURY, MASS.

"Certified" Steel Abrasives are recommended by leading Blast Cleaning Manufacturers

KORDEK
Reg. U. S. Pat. Off.

The *Perfect*
Core Sand Bond

• ▼ •

Produces castings of the highest grade with the smallest percentage of blowholes and imperfections.

Makes cores that have sharp edges and keep them.

Bakes in the shortest time.

Bakes at the lowest temperature.

Stands up when metal is poured.

Leaves a clean core box.

Breaks out of castings with greatest ease.

Gives off the least smoke and gas.

May be mixed in large quantities, and used as needed.

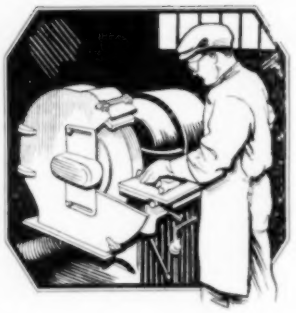
We will be glad to have one of our experienced foundrymen prove to you KORDEK is all we claim for it.

• ▼ •

CORN PRODUCTS REFINING CO.
17 Battery Place, New York, N. Y.

•1

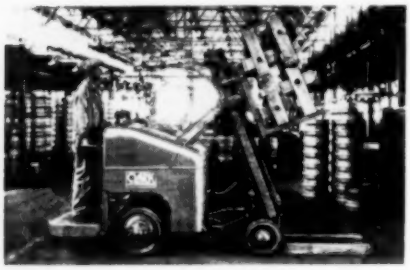
New Equipment



For Foundries

Lift Truck Has Mechanism for Tilting

A lifting, tilting, tiering truck has been introduced by the Clark tructractor Co., Battle Creek, Mich., for economical handling of heavy bales, cases, bundles and crates. This new tilting lift truck inserts long steel fingers under any load that has as much as 2 inches under-clearance, tilts it back a maximum of 20 degrees, lifts it, carries it at 1 to 6 miles an hour and tilts it forward 7 degrees to tier it safely at a height as great as 50 inches.



Long, steel fingers carry the load and require 2 inches underclearance

The lifting and tilting mechanism is actuated by hydraulic pressure supplied by an oil pump. Motive power consists of a sturdy tractor type engine, gas-powered for 24 hours' continuous operation. Rear wheel drive and four wheel steer are included in this design for flexibility. The equipment is available in two sizes, 2-ton and 3-ton.

Motor Is Protected Against Liquids

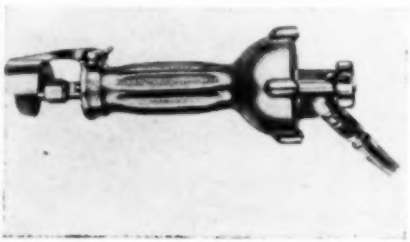
Louis Allis Co., Milwaukee, has developed a splash-proof motor to prevent entrance of water splashed under pressure from any angle, yet adequately ventilated and built in the same dimensions as standard open motors. A double baffle in an elliptically shaped air passage in each end-bell provides the protection offered by this motor, shown in the accompanying illustration.

Another feature is a shaft guard which breaks the force of a stream directed along the shaft extension and prevents water from entering the bearing chamber. The new motor eliminates the necessity for sheet metal covers which might restrict ventilation.

Rotor of Grinder Is Magnesium Casting

Madison-Kipp Corp., 225 Waubesa street, Madison, Wis., has developed a new air grinder having an operating speed of 30,000 revolutions per minute. To meet wide variation in air pressures in shops, the new unit incorporates an automatic control which governs the speed at both the high and low point of its pressure range. The speed control is of the steel finger type. These fingers, actuated by centrifugal force, automatically valve the exhaust air ports in such way as to maintain a correct flow of air when the grinder has reached its established maximum speed.

The new air grinder has a die cast magnesium rotor. Its lightness and balance provide fast pick-up, eliminate vibration and reduce the gyroscopic action prevalent when under certain conditions a mass revolves at a high rate of speed, according to the manufacturer. Exhaust valve cage and a part of the speed control also is made of magnesium. A removable wheel guard is standard equipment, facilitating the use of the device for internal grinding. The unit is 9¾ inches in length and weighs 2½ pounds.



A removable wheel guard is standard equipment on the grinder

Machine Provides High Squeeze Pressure

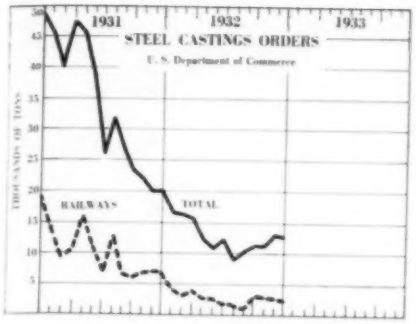
Osborn Mfg. Co., 5401 Hamilton avenue, Cleveland, has introduced a new jolt squeeze molding machine designed to give a higher squeeze pressure from the 12-inch squeeze piston than from the usual 10-inch size. With the increase in pressure has been included a decrease in the floor space required.

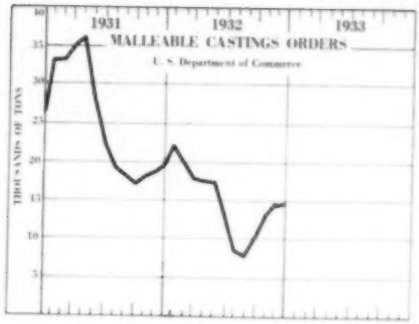
The post type head is supported on a thrust ball bearing

The post type head may be moved easily as it is supported on a thrust ball bearing. Large area cast iron bearings are included to provide rigidity of squeeze. Simple adjustments are included for regulating the heights and travel of squeeze. An adjustable automatic squeeze pressure release valve regulates the desired hardness of the mold. Head bearings are high and shielded to reduce maintenance. A pressure lubrication system protects moving parts.

Organize To Build And Design Equipment

Harry W. Titgen Co., 37th and Reed streets, Philadelphia, recently has been organized to design and build foundry and dust collecting equipment, including sandblast, cupola, blower, ladles, tumbling barrel and dust collecting units.





Foundry Activities

Reflect Industrial Trends

T. R. BRIEN HEATER CO., Hoosick Falls, N. Y., recently incorporated with $100,000 capital, has bought the gray iron foundry building and a shop formerly occupied by the Walter A. Wood Co. and will remodel them for use in producing its line of heaters. W. T. Brien, Center street, Hoosick Falls, N. Y., is one of the stockholders.

* * *

Boal Foundry & Machine Co., Fort Smith, Ark., plans to rebuild part of its plant recently burned.

* * *

Ideal Furnace Co., Milan, Mich., has been incorporated with $500,000 capital.

* * *

Newberry Bros. Pipe Fitting Co., Talladega, Ala., has let contract for a new office and pattern shop.

* * *

Old pattern shop of the Davenport Locomotive Works, Davenport, Iowa, has been destroyed by fire with loss of $150,000.

* * *

Electric Steel Foundry Co. and American Cable Co., Seattle, have leased new quarters at 2724 First avenue south, Seattle.

* * *

Lake Superior Brass & Copper Foundry, New Orleans, has been incorporated with $2000 capital to manufacture brass and copper castings, by John Ponzo, president.

* * *

Active Pattern & Foundry Co., Detroit, has been incorporated to manufacture wood and metal patterns, by Henry R. Fangmeyer, 534 East Fort street, Detroit.

* * *

Grimm Foundry Co., Bridgewater, N. J., has been incorporated with $150,000 preferred and $150,000 common capital to operate a foundry.

* * *

Detroit Moulding Corp., 2730 Union Guardian building Detroit, has been incorporated with $50,000 capital to operate a foundry and machine shop.

* * *

Big Rook Foundry Co., Chesaning, Mich., is considering remodeling and building an addition to its machine shop and tool rooms at estimated cost of $25,000, with equipment.

* * *

Wheel foundry of the Canadian Car & Foundry Co., Toronto, Ont., has secured an order from the Canadian National railways for 1000 wheels for stock purposes.

* * *

Empire Stove Co., Wellsville, Ill., has been formed with $30,000 capital and will engage in the manufacture of stoves and operate a foundry business.

* * *

Southern Equipment Co., St. Louis, manufacturer of kitchen equipment, whose plant was destroyed by fire recently, has occupied the old Liberty Foundry Co. plant, using 18,000 square feet of floor space.

* * *

Western Die Casting Co., 4065 Hollis street, Emeryville, a suburb of Oakland, Calif., and Aerochrome Engine Valve Co., 4069 Hollis street, were damaged by fire recently with loss of $75,000 to $100,000.

* * *

Stedman's Foundry & Machine Works, Aurora, Ind., has completed arrangements with John T. Hepburn Ltd., Toronto, Ont., to manufacture the products of the former for Canadian and British Empire trade. Products include crushing, grinding, pulverizing, screening and other types of machinery.

* * *

Central Die Casting & Mfg. Co. Inc., 2935 West 47th street, Chicago, recently organized, will manufacture die castings in zinc base metal and aluminum. Through an error THE FOUNDRY mentioned in the

RAW MATERIAL PRICES
Feb. 6, 1933

Iron	
No. 2 foundry, Valley	$14.50
No. 2 Southern, Birmingham	11.00
No. 2 foundry, Chicago	15.50
No. 2 foundry, Buffalo	16.00
Basic, Buffalo	15.50 to 16.00
Basic, Valley	14.00
Malleable, Chicago	15.50
Malleable, Buffalo	16.50
Coke	
Connellsville beehive coke	$2.50 to 4.25
Wise county beehive coke	4.25 to 5.00
Detroit by-product coke	8.00
Scrap	
Heavy melting steel, Valley	$8.50 to 9.00
Heavy melting steel, Pitts	8.00 to 8.50
Heavy melting steel, Chicago	5.00 to 5.50
Stove plate, Buffalo	7.25 to 7.50
Stove plate, Chicago	4.50 to 5.00
No. 1 cast, New York	4.50 to 5.00
No. 1 cast, Chicago	5.75 to 6.25
No. 1 cast, Pittsburgh	9.00 to 9.50
No. 1 cast, Philadelphia	9.00 to 9.50
No. 1 cast, Birmingham	9.00 to 9.50
Car wheels, iron, Pittsburgh	8.00 to 8.50
Car wheels, iron, Chicago	7.50 to 8.00
Railroad malleable, Chicago	5.50 to 6.00
Agricultural mal., Chicago	5.00 to 5.50
Malleable, Buffalo	8.00 to 8.50
Nonferrous Metals	**Cents per pound**
Casting copper, refinery	4.75
Straits tin	23.75
Aluminum, No. 12, producers	22.00
Aluminum, No. 12 remelt Cleveland	8.00 to 9.00
Lead, New York	3.00
Antimony, New York	5.75 to 5.80
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	2.80

January issue that the company would make products of iron, steel and nickel.

* * *

Machinery and equipment of the Columbia Iron Works, Columbia City, Ind., recently was sold at receiver's sale.

* * *

Logan Foundry & Machine Co., Logan, O., recently was lifted from receivership. Through court order, the foundry will return to its former ownership and Morris Yabrove will be the manager.

* * *

Directors and officers of the Falcon Bronze Co., Youngstown, O., were re-elected recently as follows: President, James L. Wick, vice president, J. H. Doeright, secretary, John Noll, treasurer, E. E. Miller, and C. H. Kennedy, director.

* * *

John Harsch Bronze & Foundry Co., Cleveland, has received a contract from Geo. A. Fuller Co. to furnish all ornamental and miscellaneous iron for the Archives building, Washington. The order will be in excess of $300,000. Bronze, nickel, silver, aluminum and iron will be used.

* * *

Minnequa pipe plant foundry of the Colorado Fuel & Iron Co., Pueblo, Colo., recently set an all time production record. A force of 78 men, working an 8-hour shift, with but one pit in operation produced 1262 tons of pipe in a month, breaking a record that stood for approximately 10 years.

* * *

By-Press Castings Co., Cleveland, which recently took over the die castings division of the Lester Die & Machine Co., has leased 20,000 square feet in the former plant of the United States Rubber Co. at Grand avenue and Evins road, S. E. Wilfrid J. Mahon is secretary and treasurer and Frank T. Goetz, vice president and general manager.

* * *

The new foundry of the Mississippi Foundry Corp., 1700 First street, Rock Island, Ill., affiliated with the Gellman Mfg. Co., recently was placed in operation. Mayor Chester Thompson of Rock Island officiated at the ceremonies. The plant is equipped to make aluminum, gray iron and brass castings and was erected and equipped at a cost of approximately $50,000. The following are the officers of the company: A. W. Gellman, president H. W. Reed, vice president, E. A. Gripp, secretary, and I. C. Gellman, treasurer.

New Trade Publications

AIR COMPRESSORS—Sullivan Machinery Co., 400 N. Michigan avenue, Chicago, has published a catalog on angle compound compressors. The advantages of the new development in angle compound compressor design are featured, and the ready adaptation of that particular compressor type to direct motor drive is stressed. Particular attention also is devoted to partial capacity operation, to the adaptability of the twin units, and to the power economies involved in the manufacture of special type of control.

BLOWERS—Roots-Connersville-Wilbraham, Connersville, Ind., has published bulletin 21-B23 listing a variety of uses for its portable blowing units.

AIR HEATERS—Westinghouse Electric & Mfg. Co., 2209 Ashland road, S. E., Cleveland, has published a folder describing several types of air heaters and space heaters. Specifications of each of the units described are included.

ALLOYS—H. Kramer & Co., Twenty-first and Loomis streets, Chicago, has published a bulletin listing its special alloys, fluxing alloys, and intermediate alloys. A list of products includes brass and bronze ingots, aluminum ingots and alloys, fluxing alloys and white metal.

INSULATING BRICK — Corundite Refractories Inc., Massillon, O., has issued a folder describing a high refractory, high aluminous insulating brick for temperatures from 1000 to 2700 degrees Fahr. The publication gives the main properties of the material.

STAINLESS STEEL—Electro Metallurgical Co., Carbide & Carbon building, New York, has published a booklet on "Stainless Steels and Their Uses." The booklet is exceptionally well illustrated with reproductions of photographs showing various applications.

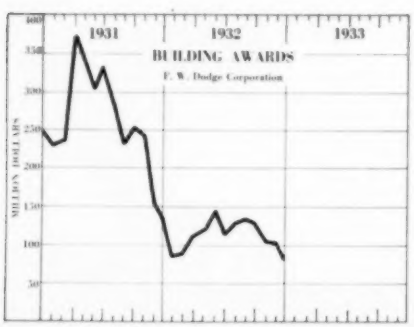
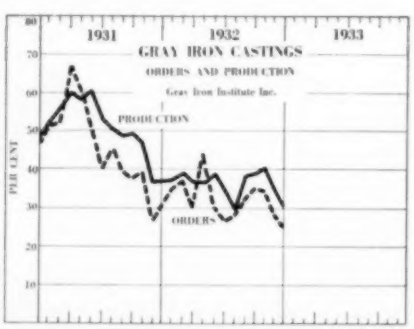
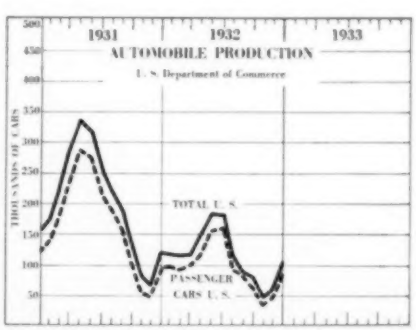
SWITCHBOARD INSTRUMENTS—Westinghouse Electric & Mfg. Co., Newark Works, Newark, N. J., has published bulletin L. 20545 describing in detail the construction, wiring connection, etc., of alternating current and direct current, radio frequency and rectifier types of switchboard instruments.

GLUEPOTS — Electrically heated gluepots are illustrated and described in a bulletin No. 193A recently published by the General Electric Co., Schenectady, N. Y. Two types of units are described, one a water-jacketed, three-heat gluepot for intermittent service and the second a one-heat gluepot for continuous service.

LEATHER BELTING — A leather belting with a nonskid surface, which, it is claimed, gives the belt greater pulling power, smoother operation, freedom from slippage, lower ultimate operating costs and other advantages, is described in a bulletin recently issued by E. F. Houghton & Co., Philadelphia. Illustrations show the application of the material.

ALUMINUM PAINT—Aluminum Co. of America, Pittsburgh, has published a catalog on aluminum paint, in which it points out how that product differs from other paints, how to secure the best results with aluminum paint, and application of aluminum paint in various industries.

FIRE BRICK—A fire brick which it is claimed is nonspalling, slag resisting, nonshrinking and highly refractory, is described in a folder recently published by Laclede-Christy, St. Louis. It is pointed out that the fire brick may be used for side walls and roofs of air furnaces, electric furnaces, reheat furnaces and installations of open hearth checkers.

CLEANING EQUIPMENT—Macleod Co., Bogen street, Cincinnati, has published a catalog describing its line of foundry equipment. Information is presented on sandblast equipment, sandblast barrels, automatic tables, sandblast rooms, dust arrestors and collectors, exhaust fans, sandblast helmets, sand sifters and separators, portable oil burning outfits, cement coating machines, etc.

TENSOMETERS — Baldwin-Southwark Corp., Philadelphia, have published bulletin No. 37 describing its line of lever type strain gages known as Huggenberger tensometers. A short technical discussion of the fundamental principles of these instruments is followed by detail data and suggestions concerning application of the various types of tensometers. A section is included describing methods of mounting and using the tensometers.